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TRANSLATION

The following definitions apply for the transliterated organizational entities included in the text:

chast' [voinskaya chast'] -- Administrative, line, and supply unit (yedinitsa) of the [branches] of troops, which has a number and banner, e.g., a regiment, separate battalion (batal'on, divizion) and troop organizations equal to them.

ob"yedineniye [operativnoye ob"yedineniye] -- Large-scale unification of various soyedineniya of the branches of troops, which is non-permanent in composition and is intended to conduct operations in a war.

podrazdeleniye -- Troop unit of permanent organization and homogeneous composition in each branch of troops, which unit forms a larger podrazdeleniye or a chast'.

soyedineniye [soyedineniye voyskovoye] -- Combination (soyedineniye) of several chast' of one or various branches of troops into a permanent organization (division, brigade, or corps), headed by a command and a staff and including chast' and podrazdeleniye of auxiliary troops and services necessary for combat operations.

Source: Russian-English Dictionary of Operational, Tactical and General Military Terms, 1958.

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Tekhnika i Vooruzheniye, No. 8, 1966, pp. 1-3

THE GOAL FOR REPAIRMEN

The decisions made at the XXIII Congress of the KPSU are having an ever-increasing influence on the life of our country. Millions of Soviet people are wholeheartedly and energetically striving to fulfill the scientifically developed plan set before them by the Leninist Party. Already there is good news about new labor accomplishments. The flame of Socialist competition is burning ever brighter in the attempt to fulfill the new five-year plan ahead of schedule.

The XXIII Congress of the KPSU emphasized that the defensive might of the country depends on the strength of the economy. This is especially true in our times when weapons are becoming more complicated and expensive, with their production demanding a high level of scientific and technical development. The Central Committee of the Party and the Soviet Government, considering the present international situation, will, during the next five-year plan, continue to strengthen the defensive might of our country, maintaining our Armed Forces at such a level so that they can deliver a crushing blow to any aggressor if he should interrupt the peaceful work of our people or the peoples of the brotherly Socialist countries.

The workers of the military repair enterprises which are rebuilding military equipment and weapons are playing a great role in strengthening of the defensive might of the country by providing this critically needed support to the army and navy. Having determined what tasks are outlined for them in the new five-year plan, they are searching for methods of increasing the economic effectiveness of labor, are trying to shorten repair periods and are trying to improve the overall quality of their work. Experience of the leading repair enterprises has proven that this can be successfully accomplished. An example of an outstanding repair enterprise is the one headed by Engineer Colonel I. Vorontsviy. Many of the indices of this enterprise, such as the cost price of the repaired items, increased labor production and total amount of repaired materiel, have been pointed out as a goal for other enterprises that are rebuilding like items. After assemblies have undergone capital repair in this enterprise they are as good as new. The Collective was awarded a Red Banner for achieving labor successes by the Council of Ministers of the USSR and the VTsSPS (All--Union Central Council of Trade Unions).

Real possibilities for increasing the economic effectiveness of production exists in other repair enterprises. Increased effectiveness will be the direct result of raising the technical level of production and incorporation of the latest scientific and technical achievements as soon as possible.

The battle for speeding up the technical progress include such problems as improving the quality of production, increasing service life of machines and providing for more reliable performance. Solving these problems is not only important because it will raise the productivity of all the laborers; it will also have a pronounced economic effect as it will be the equivalent of additional production of new articles. It is sufficient to say that, thanks to the increased potential of airplane motors which have been produced in the last three years, our country will save almost 2.5 million rubles. This is a concrete example of what can result from the creative effort of the standard-bearers of high class production.

It is within the power of each repair enterprise to achieve a basic improvement in the reliability and service life of rebuilt items. There are hidden reserves in the new technological processes as shown in the following examples. After several repair plants had been helped by scientific workers from the Voyenno-Vozdushnaya Akademiya imeni Professor N. E. Zhukovskiy and several scientific research organizations in incorporating new technological processes there was a considerable increase in the reliability of the rebuilt items. For instance, using an air-stable covering (applied with VKR-7 or VKR-9 glue) on the fabric airplane fuel tanks lowered the reject rate by 30%. Detection of magnetic-suspended matter on parts helps in finding cracks under layers of chrome. Chemical nickel-plating, the eddy current method of testing, reinforcing parts by riveting - all are reserves that will raise the quality of rebuilt equipment.

One of the departments of the Voyennoy Akademii Bronetankoviykh Voysk (Military Academy for Armored Troops) has maintained creative liaison with repair enterprises. The scientists of this department have helped initiate the system of double electrode welding of parts by using a fusing agent, have helped speed up the electro-chemical and chemical processes, and determined how to repair bearing bushings with an alloy SOS 6-6. One of the enterprises requested that the students of the Academy take on research projects to determine the best methods for reorganizing the divisions and sections of the enterprise. For example, Captain A. Ignattsyev and Senior Lieutenant N. Zenin based their project on the topic - Experimental station for tank diesels. During classes on repair the students participated in rationalizer work, conducted consultations and used any other measures that would help incorporate scientific and technical achievements into production.

It is well known that mechanization and automation are very important factors in increasing productivity and making work easier. Much has already been accomplished in this area but the raise in the level of mechanization of the basic and auxiliary work is still not great. For example, in the self-supporting enterprises of the engineer troops approximately 30% of the work was conducted by hand in the year 1965. Such a situation has a serious braking effect on the increase of the productivity of labor. This is particularly intolerable in those enterprises that have been sufficiently supplied with equipment.

In struggling to increase the productivity of labor the repair workers in one of the industries placed before themselves the mission of organizing each working place so that the worker could complete his daily work in one hour less time. With this in mind, they conducted an exchange of opinions on the construction of the work benches and the layout of the tools and then they arranged the working areas in the most efficient manner and incorporated a series of other suggestions on the organization of the work. The experience of these repairmen was then put into effect in all of the other enterprises in the area.

This example points out the tremendous significance of scientific organization of labor (NOT) for increasing the effectiveness of production. However, there are facts that point out that in many areas the scientific organization of labor has been given little attention. Often even the organization of the individual work area is not scientifically planned. The time has come when we must incorporate the scientific organization of labor in those areas where you often see idle equipment, in areas where the work is difficult or harmful, or where the cost price of production exceeds the plan and also in those primary areas on which the activity of the enterprise depends. To achieve this goal it is necessary to form creative brigades which will study and analyze the organization of labor and then come up with ideas to improve this organization. Those repair enterprises are on the right path that have created all-factory soviets for NOT which are composed of physiologists, psychologists, sociologists, artists and modelers to undertake this important task.

"Communism begins in those places," stated V. I. Lenin, "where there is selfless, determined, hard labor, concern among the ranks of the workers about increasing the productivity of labor, about safe-guarding each pyd of grain, coal, iron and other products..." These are Leninist ideas about the unceasing battle for economy of things both large and small, for the careful analysis of the activities of the Soviet workers. The battle for rational use of the basic funds, raw materials and goods, for decreasing production expenditures will, in the final accounting, increase the effectiveness of production. The repairmen remember this and will assume increased obligations in honor of the 50 years of Soviet power. Thus, the repairmen of the enterprise, where the chief is Engineer Colonel Ye. Kaplan, have economized material which amounts to 1.5 percent of the planned cost of the produced goods.

The tank repairmen in one of the industries are battling for economy over that called for in the plan to the amount of 25,000 rubles, and will save 8 tons of ferrous and .5 tons of non-ferrous metals. In several of the enterprises up to 50 percent of the parts were rebuilt with their own force. This permits effective use of the equipment on hand, helps in the growth of productivity of labor and lowers the cost of repairs. The enterprise headed by Engineer Colonel A. Chuprikov achieved economy of approximately 14% from only the rebuilding of parts.

The effectiveness of production depends on the rational use of the basic funds, goods and raw materials, and on decreasing production expenditures per unit. Yes, each percent of decrease of expenditure in industry increases our national fund by more than 1.4 billion rubles. This is the reason that it is so important to develop massive participation in the quest for economy and thrift. This will permit rebuilding of greater quantities of equipment and weapons with a significant saving of government means.

In the advanced guard of the thrifty are our inventors and rationalizers. They have taken on a large role in the development and improvement of the technology of production, in increasing the productivity of labor. We must continue to create the most favorable creative conditions possible for the fruitful activity of the inventors and rationalizers and the members of the scientific-technological societies.

The XXIII Congress of the KPSU has called for the Soviet people to celebrate two important dates - the 50th Year of the Great October Revolution and the 100th year since the birth of V. I. Lenin - with wide spread competition, movements for Communist labor, new achievements in the building of Communism. In the ranks of the competitors - our army and navy repairmen. They are taking on such obligations as fulfillment of plans ahead of time, increasing the productivity of labor, achieving economy over that called for in the plan and of receiving profit from each rebuilt item. The main goal of the obligations of the competitors is to increase the quantity of rebuilt assemblies, parts and machines; to have no defects in their production, and introduce complex mechanization for loading and unloading of material. The obligations of the repairmen call for a decrease of hand labor, introduction of mass production methods and increasing the technical level of production.

In this competition the repairmen seek higher and higher goals, putting forth their labor for their beloved country and thus help to strengthen its defensive might.

Tekhnika i Vooruzheniye, No. 8, 1966, pp. 4-10

THE HIGHEST STATE OF READINESS

by Lieutenant General of Aviation, N. Skomorokhov,
Twice Hero of the Soviet Union, Delegate to the
XXIII Congress of the CPSU

As noted in the Declaration issued at the Meeting of the Political Consultation Committee, which was attended by governmental representatives of the members of the Warsaw Pact, the current policy of the USA is a direct threat to peace in Europe and is dangerous for the people of Europe. This policy is even more dangerous because it is supported by the treaty with the military forces of Western Germany. Between the American imperialists and the Bonn revanchists there is a bi-lateral union, in which each of the partners urge the other toward more risky adventures.

Western Germany has a half million Bundeswehr and a forced military economy which is preparing a base for production of their own nuclear weapons. And in the meantime on the Rhine River you can hear louder and louder demands for access to nuclear weapons and about the so-called "equal rights" in the development of the nuclear strategy of NATO. The policy of the Bonn leaders is to receive such weapons and with their aid revise the results of the Second World War.

Thus, a very small strip of land contains the armed forces of the aggressive NATO bloc and the defensive organization of the Warsaw Pact. Provocative acts can be expected at any moment. This gives the soldiers in the Soviet Forces in Germany a special responsibility for maintaining an unsleeping vigilance and a high state of military preparedness. There are many outstanding personnel in the Air Force in this region. They are all prepared to conduct decisive military action in modern war. This was attested to, in particular, by the results of the combined exercise October Storm conducted by the armies of the Warsaw Pact. In this exercise the activity of the Soviet pilots received a high evaluation from the combined commanders. They were masters in the art of intercepting and destroying their airborne targets at various altitudes. The engineers, technicians and mechanics proved that they could quickly prepare the planes for flight and service them in conditions which were very similar to combat.

In its basic construction and armament the present-day airplane is a very complicated piece of equipment. In the modern airplane there are thousands of various assemblies, some of which must be built to within an accuracy of one micron, there are hundreds of bulbs, transistors and wires, dozens of automatic instruments which must be adjusted for not only the stress of flight (speed, altitude, force of gravity) but also for atmospheric conditions (temperature, air pressure and dampness).

The new equipment demands that each person who is preparing the plane for operations and flights must have excellent theoretical knowledge and practical skills and must be an expert in maintenance. The failure of a microswitch or one of the warning lights could cause one of the assemblies or systems to fail. The failure of one of the systems will, as a rule, make flying the airplane very difficult and in some situations could create a dangerous situation which could only be solved by an experienced pilot.

The operation of the equipment without accidents and breakdowns - the most important task of all aviators. In order to achieve this, there must be an increase in the use of testing instruments. But before incorporating this it is necessary to resolve a whole series of organizational and technical problems. You must designate which specialists, in what period of time and to what extent the checks should be conducted, how should the changes in the testing instruments be analyzed so as to be able to correctly evaluate the condition of the airplane assemblies and systems.

The officers of the engineer-aviation service have worked out a list of parameters pertaining to systematic changes in highly precise instruments; have determined the technology of measuring and the methods of analysis; have selected the apparatus (including self-registering and defect detection); and have prepared a series of stands and devices. In order to conduct the checks quickly the apparatus is placed on trucks.

All of the measurements are noted in a journal and compared with other checks conducted in the past. A careful analysis of gradual changes in the parameters will help prevent an assembly from exceeding the permissible norm and thus prevent a breakdown of the equipment. In conducting such an analysis a group of instrument operators, headed by officers V. Priyemov, V. Sabodazh, B. Stepanov and A. Medvedyev, were able to determine individual deficiencies in the equipment before it actually broke down.

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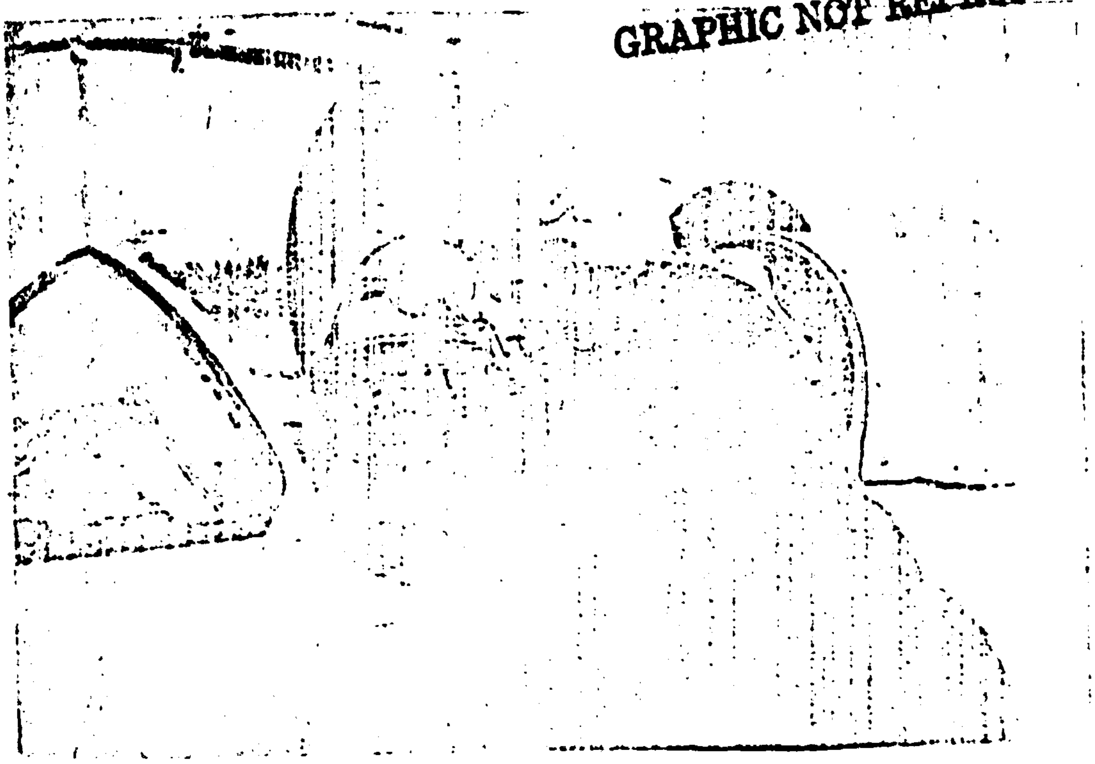


Captain F. Zinov'yev - an experienced pilot. But, in spite of his rich practical experience he still spends much time on the ground in preparation. In the picture: Captain Ye. Kozhayev (on the right), Commander of an Aviation Squadron, and Captain F. Zinov'yev conduct training in the cabin of the airplane.

Photograph by L. Chupin

Continuing work in this direction, officers V. Bukharov, Yu. Solov'yev and L. Dmitriyev are increasing the number of checks made by instruments and are searching for new methods of improving operational reliability of the equipment. The officers A. Nikolyenko and A. Tyryshkin have constructed a testing-checking instrument (KPU) which allows you to check the assemblies without taking them out of the airplane. This instrument has not only improved the quality of the work, decreased the time required and number of specialists occupied with this work but has also fully excluded the possibility of making any mistakes in disassembly and assembly of the tested part.

Successful completion of the military training mission depends to a considerable extent upon how well the pilot maintains the proper speed, altitude and force of gravity while completing the maneuver. Therefore the aviators are making more use of gun cameras, barometric recorders and other instruments. Not too long ago this equipment was used only on special exercises or during check flights, but at the present time they are used in daily flight training. Much initiative and perseverance was shown by the officers V. Chichkan and A. Tsybul'nik when they created the necessary conditions for the pilots so that there could be an all-encompassing analysis of their flights. In a specially equipped room the pilots can examine the film from his gun camera, check his barometer readings and other self-registering instruments and thus re-create the entire picture of his flight, conduct a self-analysis and learn from his mistakes.

From month to month there is an increase in the chast' of classified p'lots, technicians, mechanics, communications specialists and rear area specialists. For instance, in one of the chast' there are only first and second class pilots and more than 95% of the technical personnel are classified specialists. There is an increase in the number of outstanding wings and groups. The personnel in the podrazdeleniye commanded by Captains B. Obolyenskiy, L. Solomakh, V. Veselkin, Captains in the Maintenance Service, V. Chizhikov and A. Lastochkin and senior technical-lieutenants Ye. Pashko, V. Akulov and V. Naymov are all outstanding examples of people that have fulfilled their military obligations.

As is well known, the military mission assigned to the aviation chast' must be, in the final account, accomplished by the pilots. However the results of their work not only depends on their own personal mastery but also on the mastery of the technicians, mechanics, officers and soldiers in the Command Post, the radio-location and radio-technical podrazdeleniye and the rear area specialists. Each of them must work with complicated equipment which he must thoroughly understand. Therefore, technical preparation must be given special attention.

The pilots, staff officers, political workers, technicians and mechanics must continually study their equipment to the extent necessary for each category of equipment. In line with the widely accepted forms of technical training (for officers, planned individual study and group activities; for soldiers and sergeants, group activities and practical exercises), consultations are organized and conducted by well prepared engineers. One or two times a year, before starting a new task, training sessions are conducted. The amount of time allotted for these sessions depends on the complexity and newness of the task that is before them.

They also can improve their technical knowledge by attending evening classes in the technical universities and by lectures. Experience has shown us that in working out the lesson plans for the evening university classes or lectures it does not pay to deal only with theoretical science. In the majority of the evening university classes or lectures topics are planned on such subjects as practical aerodynamics, theory of jet engines and increasing the knowledge (on a theoretical basis) of actual types of equipment. The officers are eager to attend such classes. Therefore, each topic is closely connected with practical work and is accepted much better than if it dealt only with pure theory. Also, if someone misses one of the classes for a reason such as guard duty, sickness or leave, then he does not have such a difficult time mastering the scheduled topics.

At the present time there are more and more classes preparing junior specialists for their examinations for higher classification. These classes are organized so that specialists that have approximately the same level of learning are grouped together.

The aviators from one of the chast' found an interesting method of discussing technical questions. On flight days the flying and engineer-technical personnel assemble a display of the various systems, parts and instruments in the rest area. Under a sign, "HOW DO YOU ANSWER THIS?" were posted several questions pertaining to the items in the display. The pilots eagerly entered into discussions, debated on the various questions and thus brought out all the important points.

Another useful form of training is a critique where all possible malfunctions of the equipment are analyzed. During this critique the officers must recall from memory the construction of all of the parts and systems and analyze their functions; sometimes the discussion centers on the theoretical operation of the equipment. Such critiques are of great value and create interest and love for the equipment of our country.

Military action conducted in conditions of nuclear warfare may require that airplanes land on airfields where there are ground control systems but no engineer-technical staff capable of servicing an airplane of that given model. In this case the pilot must personally prepare his aircraft for the return flight or be capable of supervising the work. Therefore he must have excellent knowledge of the airplane in order to be able to supervise such operations as replenishing POL products and compressed gases, reloading the ammunition and pre-flight check.

In order to help the pilot conduct these operations a special check-list has been written. As far as this type of training is concerned, it should be conducted in the following sequence: missile launcher inspection and refilling the fuel, compressed gases, nitrogen and oxygen containers. All of these operations must be repeated until the pilot receives an "excellent" evaluation score. Experience in conducting training has shown us that it is absolutely necessary for the pilot to master these operations.

The high quality of training depends directly on the training material that is available. The pilots have paid much attention to perfecting this base. In each chast' the pilots, engineers and other specialists have themselves built training classrooms for aerodynamics, preventive maintenance, flight control, flight gunnery, tactics, means of protection from nuclear weapons, planning, engine operation, radio-electronic equipment and armament.

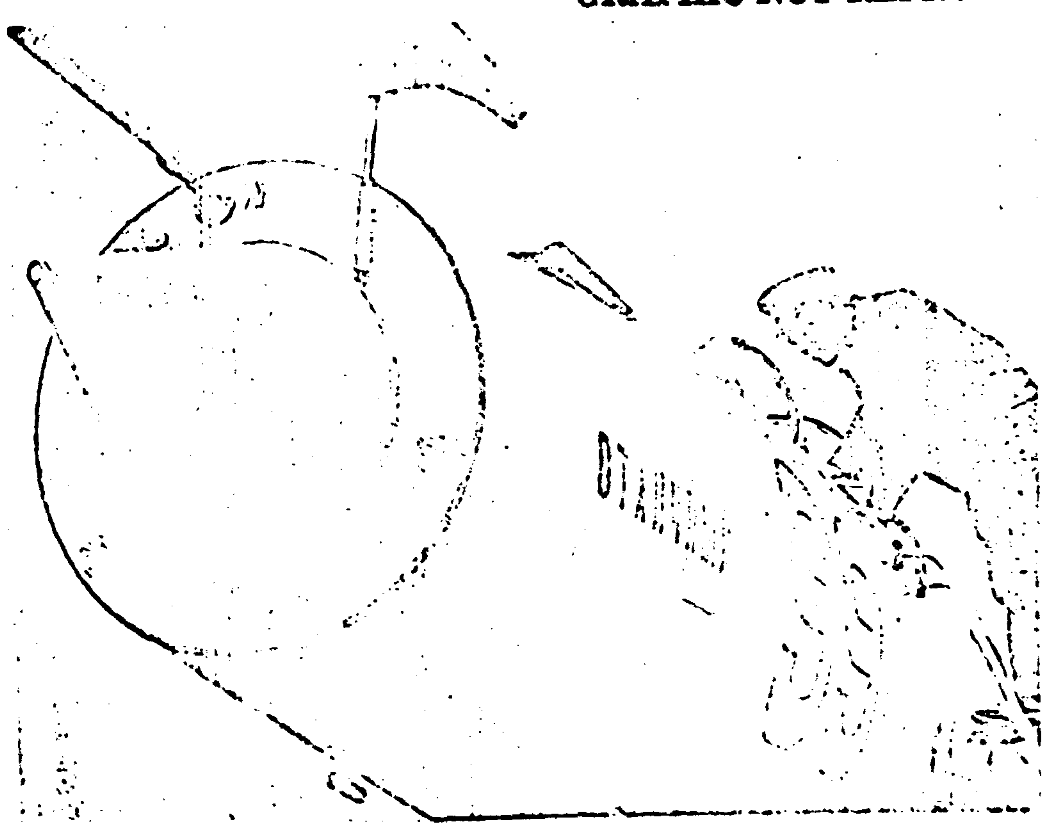
Listed below is an example of a training base established in one of the chast'. In order to study new equipment twice as many classrooms were needed. Where can you find that many classrooms and how can they be equipped? Initiative will help. Next to the staff headquarters was a half-ruined building. The aviators decided to rebuild it with their own hands. In the group of aviators were found brick-layers, plasterers, painters and carpenters. The work progressed rapidly and within a short period you could hear the sound of a bell, signaling the start of classes. Five groups of pilots, technicians and mechanics began to study new equipment in the new classrooms.

Under the leadership of the officer L. Sharopov, an enthusiastic group built working models of all of the navigational instruments, automatic assemblies and electronic equipment. The rationalizers have built a working training aid for studying air-to-air missiles. With the help of this training aid it is possible to conduct the entire operation from locking on the target to its destruction.

A significant help in training the personnel is a device known as an examiner-repeater. The officers B. Merkulov and L. Sharapov worked out an original attachment which permits the pilots to work out the correct sequence of operations necessary in the cabin of an airplane.

While training the pilots for flying, various types of training aids are used. The pilots work out problems of flight on them and must calculate what their action should be in any type of a situation that may arise. Training helps them make the correct decision when it is necessary, during actual flying, to quickly maneuver the airplane or react to an unexpected threat that arises.

It must be said that the training aids have somewhat lagged behind the development of airplane equipment. During the course of training new types of maneuver arise which have not been worked out in the flight trainer. Such backwardness is not permissible and the rationalizers are successfully liquidating this unfortunate situation. The officers A. D'Yachkov and A. Kirichyenko have modernized the trainer in which the pilots work out complicated types of maneuver. The officer I. Koryetskiy re-equipped a trainer so that the gun-sight could be used more effectively and the target detected quickly.



This airplane, which is serviced by Technical Lieutenant V. Kuz'minskiy, has been selected as - OTLICHNIY - It is always ready to fly. On the picture: Technical Lieutenant V. Kuz'minskiy checks the airplane prior to the flight.

Photo by L. Chupin

The officers of the engineer-aviation service are trying with all their might to improve the organization of labor. This is completely understandable. If the smallest particle gets into the hydraulic system then the entire system of the plane may malfunction. At the present time the personnel work in white coveralls. At the same time they are improving the planning and production processes. A chart has been worked out for all of the basic operations conducted by the various types of specialists. It must be pointed out that the chart currently being used in the TECh (Technical maintenance unit) provides for a saving of time, permits timely completion of all of the work and more evenly distributes the workload.

A powerful stimulus in increasing the creative activity of our military personnel is socialist competition. Even in the period prior to the XXIII Congress of the KPSU, it was undertaken by the personnel of all of the chast', without exception. The pennant awarded for "Outstanding Airplane" became the permanent property of many airplanes.

It is not possible to list the names of all of those personnel that pleased the Congress of the Communist Party with their new achievements in military and political preparation, who achieved such a level of readiness that their airplanes were continually prepared to fulfill any assigned task. We will single out only the Officer S. Mishukov who is in charge of the engineer-aviation service in a squadron. Thanks to the correct organization of work in this squadron the expenditures for labor for each hour of flight have been lowered by 10%. As compared with other squadrons this squadron has decreased the time for preparing the equipment for flight by 20%. These are excellent indices.

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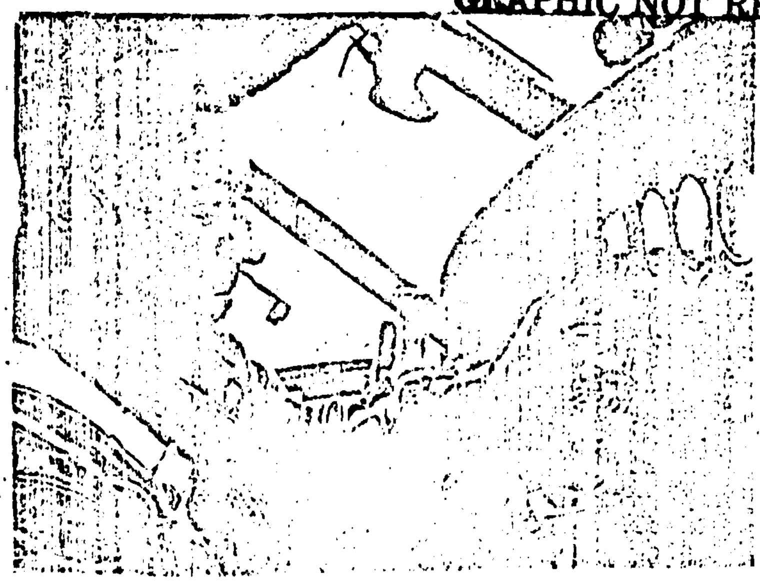


He arrives at the airport before the pilots, flys with them in the airplane and leaves the airport only when he is sure that the plane is ready for the next scheduled flight. Such is the duty of the flight technician P. Kalistratov. He has served many years in aviation and passes on the benefit of his experience to the younger service personnel. In effect he is a flight technician instructor. On the picture, Captain of the Technical Service P. Kalistratov checks the equipment in the cabin prior to a flight.

Photo by F. Levshin

All obligations, taken by the pilots in honor of the XXIII Congress of the KPSU, have been fulfilled. At the present time, socialist competition is being initiated in honor of the 50th year Jubilee of the founding of Soviet Power. Our nearest goal is the 49th anniversary of the Great October Revolution. For example, by this date the personnel in one of the podrazdeleniye intend to have 70% otlichniks in military and political preparation. It is pledged that 60% of the crews, 75% of the wings, 80% of the groups and 75% of the otdeleniye will achieve and maintain the rating of otlichnik. Their goal - no malfunctions of the aviation equipment during the summer flight training. The older service personnel have obligated themselves to finish their service with outstanding results and successfully train their replacements. 75% of the personnel have stated that they will achieve the title of "Sportsmen" and "Military Sportsmen." There is no doubt that all of the obligations will be fulfilled with honor.

All of the personnel have an intense feeling of personal responsibility for the protection of their motherland and all countries of the socialist camp, and have vowed to take a scientific approach to the organization of labor and military training, and unceasingly improve the technical level so as to provide for uninterrupted training of aviators and thus insure a higher level of military preparedness.

Tekhnika i Vooruzheniye, No. 8, 1966, pp. 8-9

In honor of the 50th year anniversary of the Great October Revolution

HIGH OBLIGATIONS

by Major A. Zhdanov

Socialist competition is gaining momentum in honor of the 50th year celebration of the Great October Revolution. The PVO (air defense) aviators from the N--skov chast' of the Moscow Military District are also participating in this competition. Enthused by the decisions of the XXIII Congress of the KPSU they are persistently battling for further improvement in the military preparedness of the podrazdeleniye and for increasing the number of otlichniks,* classified specialists and sportsmen.

At the present time we are conducting intensive summer training. After studying in the classroom and working in the trainers, area training flights and training on aerial gunnery many of the pilots have shown a high state of mastery on the missile firing range. As a rule they destroy the target with the first shot. An example of a first-class fighter pilot is Major N. Kulikov, who in spite of the dark night and the difficult conditions of the battle, destroyed the target during his first attack with the first missile.

Not lagging behind Kulikov are his co-workers Majors V. Kryuchkov and V. Filat'yev. They also fired the missiles accurately. These experienced aviators have convincingly shown that hard training pays off and that the pilots must be accustomed to difficult conditions so that in a real battle they would be able to destroy the enemy.

In the chast' there are many pilots of this type. Each flight mission has been completed with a score of "excellent" or "outstanding" by Captain V. Tur. This is the reason that the officers seriously and carefully prepare themselves for each flight, regardless of how difficult the conditions are.

The successes of the aviators in achieving military preparedness are the fruits of the collective strength of the pilots, technicians, junior aviation specialists and the singleness of purpose of the commanders and Party and Komsomol organizations.

The Communists and Komsomolists here take active participation in maintaining military order and achieving high technical culture. They are also foremost in initiating the battle for accident-free flights, insuring strict observation of the regulations, making sure that flight training schedule is followed and for continuing the military tradition.

During the past war the pilots of this chast' shot down more than 100 enemy planes, destroyed much equipment and killed many of the enemy personnel. Dozens of pilots, technicians and mechanics were awarded decorations and medals for bravery in action and the fearless fighter pilots I. Kholodov, Ye. Gorbatyuk and A. Fedorov were awarded the medal of Hero of the Soviet Union.

*An otlichnik is a person that has excelled in military or political preparation.

The younger generation of pilots are doing everything possible in order to bring more glory to the chast' and to improve their military preparedness. Let us take, for example, senior technical Lieutenant Myazin. You hear much praise about him. Not long ago a commission checked the condition of the aviation equipment. The missile transporter serviced by this excellent, hard-working officer received a high inspection report. Now you can see the word "otlichniy" (outstanding) on the side of the transporter.

The aviators finished the first period of training with high indices. The chast' was one of the leading units in the Military District in military and political preparation. But this is only the beginning. All of the personnel decided to achieve even greater successes - to win the award of the banner of the MGK of the KPSU and Moscow Soviet of Working People's Deputies. This will not be an easy task. This means that they will have to work with full force or they will not achieve the desired goal.

The pilots, engineers, technicians and mechanics are actively participating in socialist competition and, to the greatest extent possible, are taking on greater obligations.

For example, the personnel of a squadron commanded by Major V. Ponomaryev decided to achieve the title of outstanding podrazdeleniye. By the day of the 49th anniversary of the October Revolution they intend to have 90% outstanding wings in the group, 80% outstanding crews, and 90% classified specialists (of these no less than 60% must be first class specialists). Each person in the squadron has vowed to pass the test for military-sportsmen and to achieve only "excellent" and "outstanding" scores on the firing range.

Other podrazdeleniye have also assumed similar high obligations.

Tekhnika i Vooruzheniye, No. 8, 1966, pp. 11-13

INSTITUTING INSTRUMENTAL CHECKS

Engineer Lieutenant Colonel A. Ugarov

Preparing a modern airplane for a flight without using checking and measuring instruments is unthinkable. This is a true statement and there are many indicators to prove its validity. Only with such apparatus can you obtain objective data about the condition of the assemblies and automatic systems of the airplane. Each TECh (Technical maintenance Unit) is outfitted with this equipment. But, in order to check the assemblies and systems to the desired degree of accuracy it is necessary to dismount them from the plane and take them into the TECh.

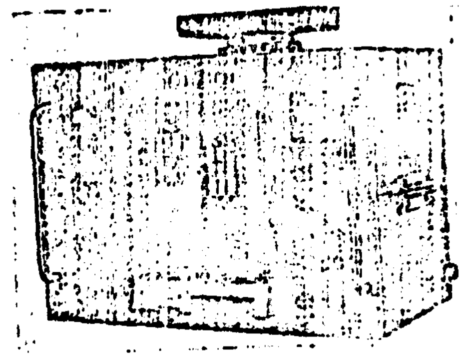
There are checking-measuring instruments on board the aircraft. However, they are not sufficiently accurate and it is not possible to detect small deviations from the normal parameters with them. For instance, there is a small instrument in the cabin for determining engine revolutions that is accurate to within 1%. With such an instrument it is very difficult to notice deviations that are a fraction of a percent or even as large as one-half a percent. People say that this does not mean anything. They are wrong. The limits of the working elements of the automatic compressor are measured in fractions of a per cent and the hysteresis of other automatic assemblies is approximately 3%. If, during flight, the number of revolutions of the motor decrease by only 1% there will be a resultant loss of more than one hundred kilograms of thrust. Further, the mandatory limits of hysteresis will not be maintained - this will result in the compressor stalling and the engine will have to be restarted in flight.

Our inventors and rationalizers are searching for methods of constructing instruments that will provide sufficient accuracy in checking the assemblies and systems.

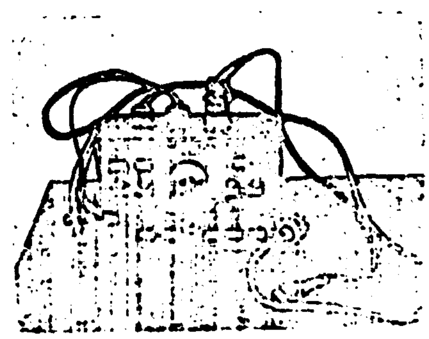
Previously the electrical assemblies had to be taken from the airplane and checked in the TECh. Now, this is not always necessary.

Sergeant V. Perekatiyev, an aviation mechanic, developed a small, convenient, portable instrument (see picture No. 1), with which it is possible to measure the parameters and check the entire operation of the electrical mechanisms MG-2, UT-2d and electric motor PTsR-1./ It also serves for checking the electric circuits in the thermal switch. The creation of such an instrument permits testing these assemblies without dismounting them from the plane.

It is possible to list many suggestions made by other rationalizers all of which have the goal of increasing the accuracy of the checks. Senior Lieutenant M. Demchyenko constructed a stand for checking the thermal switch and Captain of the Technical Service I. Remizov and extended-service Master Sergeant V. Dutov built a portable electrical instrument for checking the entire armament system. Extended-service Senior Sergeant V. Kusnyetsov constructed an instrument for checking the automatic compass ARK-10 (see picture No. 2). With this instrument it is also possible to measure the sensitivity of the receiver, the speed of the automatic roll control gauge, the amount of electricity required by the DK-1A motor and the scale gradiation and frequency accuracy of the repeater set. The altimeters, radio sets and landing systems are all checked by instruments which have been built by specialists in radio equipment. As a result, the amount of time necessary for checking has been considerably reduced and the accuracy of the measurements has been improved.



Picture No. 1. A portable instrument for checking electrical circuits and electrical assemblies.

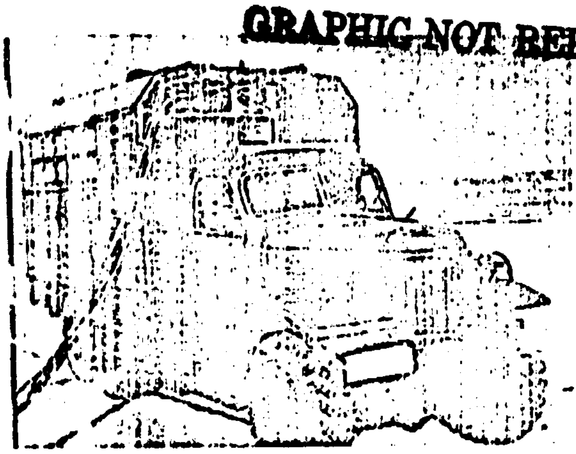


Picture No. 2. Instrument for checking an aviation radio compass.

The effort to achieve more precise checks of the condition of the aviation equipment in the period between scheduled checks has shown the need for instruments that will help maintain a proper state of readiness. The question arises as to who will maintain these instruments and how can they be used in field conditions.

It was decided to form a non-organizational group, headed by the best qualified airplane technicians, which would conduct the checks of the equipment. The checking instruments were placed on a truck (see picture No. 3). The various pressure gauges, tachometers, voltmeters and signal lights were mounted on panels in the covered body of the truck. These instruments were mounted on four control panels. The first panel checks the engine and automatic compressor; the second, the turbostarter; the third, the systems of the airplane; and the fourth, the electrical system.

Engine revolutions are indicated by the ITS-2 gauge. This instrument is connected with the RPM indicator on the motor. The moving parts of the automatic compressor are checked with the help of a signal lamp located on one of the panels in the mobile laboratory. The fuel pressure of not only the basic fuel system but also that of the afterburner is checked by using the connection located on the pumping system near the fuel pressure gauge on the airplane.



Picture No. 3. A mobile laboratory used by the group conducting checks of the airplanes.

The mobile laboratories are continually being improved. A. Kozlov, electrical mechanic 2nd class, proposed and constructed a special tool which permits checking of the automatic parts simultaneously in the cockpit of the airplane and on the control panel in the truck by use of signal lights.

A hydraulic pump NP-34 and a GSP-6000 generator have been mounted on the differential of the ZIl-164 truck. This makes the laboratory independent as it has its own source of electricity and hydraulic pressure.

The group has taken on the mission of increasing the number of assemblies that can be checked and determining what the parameters should be for the checks. For example, while testing the engine it is impossible to check the movement of the distributor with the instruments and signal lights in the cockpit of the airplane. This is tested only during the scheduled checks. Senior Lieutenant M. Malygin and Privates A. Kozlov and A. Stegniy constructed a special connection which was attached to a switch in the airplane and a tumbler switch in the laboratory. Any movement of the distributor will now light up a signal light on the panel in the laboratory. Simple, but the effect is great. Now at any moment, it is possible to check the distributor.

The groups that are checking the equipment have already had considerable experience. Here is a good example. During one of the preparatory tests the specialists checked the condition of the airplane flown by the officer A. Gazyeykin and discovered an abnormality in the fuel pressure while the engine was running. When the revolutions of the engine were increased the needle on the tachometer did not change. The engine was switched off and the valve on the supercharger was checked to see if it were functioning properly. It turned out that it did not work properly under back-pressure. It was taken into the TECh and every part carefully checked. A small defect was discovered on the cover. Because of this the valve did not close properly when the engine was running. Thus, a possible cause of an accident was eliminated.

It is necessary to note that, thanks to wide use of accurate checking-measuring apparatus, which is located in a mobile laboratory, the complicated work of checking the airplane has been mastered.

We are not the only ones that have such machines. Other podrazdeleniye have also built such laboratories. In one of them all of the equipment necessary for making checks and adjustments is placed, for example, on a rebuilt KRA S-1p truck. In the truck body there are special compartments for hoses, batteries and air cylinders. There is a two-sided communications system established between the airplane and the laboratory. In order to organize the work the specialists in the group have written up a series of technical documents designating how the checks must be conducted. This not only speeds up the operation but almost completely precludes the possibility of making errors. The measured parameters of the systems in the airplane are written down in a ledger which is maintained for each individual airplane and engine. With this ledger it is very easy to diagnose malfunctions or deficiencies.

For this purpose it is necessary to determine how the system functioned during the course of several checks. If it appears that the parameters continually deteriorate then it is necessary to take measures to eliminate the defect, even though it still has not affected the work of the system. During the process of checking the parameters precise measuring instruments make it possible to discover deficiencies which earlier would have been very difficult to detect. For example, determining the degree of loss of pressure or a partial jamming of the throttle mechanism, causing loss of speed, and many others. The following example illustrates this very well. On one of the airplanes the parameters of the engine were checked and it was noticed that the maximum revolutions of the low pressure rotor fell to 97% and then the number of revolutions increased. Having measured and analyzed the parameters of the system, they managed to establish that there was a shrinkage in a spring which limited the maximum number of revolutions of the TRD (turbojet engine). The system was quickly adjusted and the engine began to operate normally.

Not too long ago a group of these personnel that conduct checks with various instruments participated in training on a dirt airfield, where they proved to be of great assistance to the technical personnel in checking and preparing the airplanes for flying.

At the present time mobile laboratories are found in almost all of our chast' and podrazdeleniye and permit the checking of dozens of parameters which reflect the reliability of the basic systems of the airplanes and engines. However all of them are constructed differently. In our opinion, it would be a good thing if all of the experience gained thus far were gathered together and centralized production of mobile laboratories be initiated, based on the results of this experience.

Tekhnika i Vooruzheniye, No. 8, 1966, pp. 14-15

MAN'S RESTLESS SPIRIT

by

Lieutenant Colonel V. ALEKSEYEVSKIY and Major S. KOSTYANOY

Captain of Technical Services Vladimir Fedorovich ALEKSANDROV's name is widely known in the Southern Group of Forces. He is an active participant in many constructive consultations, conferences of rationalizers, and other activities to which he generously gives of his rich experience in servicing aviation equipment.

"A man of restless spirit!" his commander calls him. And this is really so. He is all business, this Party leader of the Technical Maintenance Chast' (TECh) and Chief of a progressive group that makes adjustments. He is always concerned with how to shorten the time required to make adjustments and how to improve their quality. The regiment's combat readiness, and the accident-free operation of aviation equipment, is greatly dependent on such work. Captain V. ALEKSANDROV has more than thirty rationalization proposals to his credit. And for each of them there were many sleepless nights, much though and much searching.

... A distributing tower, from which cables and air hoses lead out to three aircraft at once, dominates TECh area. One group of specialists checks the electrical equipment and instruments, another carefully inspects the air systems, and a third checks out the brakes of the machines. Each man is busy with his work; no one wastes valuable time.

And how did it used to be? The airfield start unit (APA) was driven up to an aircraft and the electrical equipment check-out was begun. The other aircraft, without electrical supply, waited their turn. It took longer to complete the adjustments because time was used inefficiently. The same applied to supplying compressed air to the aircraft.

"We must think of some way to speed up the work." This thought troubled Vladimir Fedorovich. He persistently sought a solution, made calculations and computations, and drafted new systems. When the final solution took shape, ALEKSANDROV shared his scheme with officer N. DAN'SHIN and Sergeant R. Safin, a soldier voluntarily serving beyond the required period of service. They warmly supported the group chief's idea and joined in the project. Several months later, a distributing tower, comparable in technical quality to factory models was erected in the TECh area.

Since that time, the need for APA's has diminished. The tower built by the experts takes its power supply from an industrial network and simultaneously supplies it to several machines. Also very important is the fact that the tower is easily dismantled and can be used under field conditions. In the field, it receives current from one of the APA's and simultaneously supplies it to several aircraft. Thanks to this, the mobility of TECh has been increased considerably. These towers are now in use in other units of the Southern Group of Forces as well.

Here is yet another original modification created by V. F. ALEKSANDROV. It looks like an ordinary flare pistol. This is a portable panel for checking heat indicators. They are mounted on the aircraft in order to warn the pilot in case fire breaks out. Heat indicators require regular checking and have to be removed from the machines periodically and sent to the laboratory. Here this special and costly factory-type device sits on a table. But that is not all. It takes an extreme amount of power from the network. Suffice it to say that when it is cut in work stops in several of the TECh laboratories. Moreover, even a good specialist has to spend a lot of time on dismantling and reassembling the heat indicators. By using the portable panels designed by ALEKSANDROV, the heat indicators are checked right in the aircraft. The time for completing the operation has been cut by fifteen times. The resultant expenditure of electric power is much less.

Vladimir Fedorovich has drawn almost all of the men in the adjustment group, which he leads, into rationalization work and each of them has contributed two or three valuable proposals. Creative thought is in full swing in this harmonious group.

The aviation specialists are fond of their group chief. They admire extensive knowledge of aviation equipment, keenness of mind, strong character and high Party qualities. He knows how to find the way to a soldier's heart, win over his subordinates and give good advice. This is why people are drawn to Vladimir Fedorovich, believe in him, and warmly support his fine efforts.

Even long before the beginning of the work of the XXIIId Congress of the CPSU, officer V. ALEKSANDROV sought the advice of his subordinates about what pledges should be made in honor of the Forum of Communists and what resources should be used for further increasing the group's combat readiness and the training of the personnel. Each proposal was thoroughly discussed and the pledges were drawn up jointly. The men made a firm decision to retain the title of excellent podrazdeleniye for the adjustment group this year. Here the patriotic motto of "Excellent results each day" was born. Organizing themselves according to tasks and norms, the aviation specialists fulfilled their pledges day after day, week after week, and month after month.

The results of the aviators' intense labor were summed up on the eve of the XXIIId Congress of the CPSU. Again the group headed by Captain of Technical Services ALEKSANDROV came out the victor in the competition. This was the second year in which there were no infractions of military discipline. Almost all the technicians and mechanics are high-class specialists. Each soldier has some type of related specialty. For example, electrician PFC Gavrilyuk mastered the specialty of chauffeur and mechanic-electrician Dubinin learned how to be an instrument man.

Thanks to a high degree of political awareness among the soldiers, the painstaking individual work of the officers and the Party organization among the personnel, great successes were achieved by the group. Through an in-depth explanation of the historic resolutions of the XXIIId Congress of the CPSU, the group chief and the Communists of the podrazdeleniye instill in the aviators a spirit of love for the Motherland and the Communist Party and foster in them a sense of personal responsibility for being model soldiers when stationed outside their native land.

The aviators took upon themselves increased obligations in response to the resolutions of the Party Congress. Their aim is to maintain combat readiness at an even higher level, as required in the interest of defense of our Socialist state. Captain of Technical Services Vladimir Feforovich ALEKSANDROV, a first-class specialist, a demanding and strong-willed officer, and Secretary of the TECh Party organization, is leading them on to the heights of military mastery. The soldiers are proud of the fact that the medal "For M tary Service," with which the Motherland honors her deserving ons for successes in military and political training and in mastering new equipment, appeared on his chest this year along with other governmental decorations. In this decoration, they see part of their own military labors for the welfare of the beloved Mother country.

GRAPHIC NOT REPRODUCIBLE

Captain of Technical Services V. F. ALEKSANDROV

Tekhnika i Vooruzheniye, No. 8, 1966, pp. 16-19

THE ORIGINS OF HELICOPTER BUILDING

by

N. I. Kamov

Soviet rotary-wing aircraft are widely known in our country and abroad. They gained universal recognition at the world-wide aviation exhibit which took place in Paris last year. Soviet helicopters surpassed many foreign models in their flight qualities. This is the opinion of foreign specialists.

The successes we attained in this field were not accidental. Russian and Soviet scientists, designers and engineers have made outstanding contributions in establishing and developing domestic aviation equipment. The names of B. N. Yur'yev, I. P. Bratukhin, M. L. Mili, and other pioneers of helicopter building enjoy universal fame.

Nikolai Il'ich Kamov contributed greatly to the creation of the helicopter. The KA-10, KA-15, and KA-18 aircraft and the rotary-wing KA-22 were built by the personnel of the Design Bureau he heads. The twin-engine KA-26 helicopter will appear in the sky in the near future.

Chief Designer N. I. Kamov tells of the origin of Soviet helicopter construction in his memoirs.

More and more, helicopters are becoming part of our life. They have found broad application in agriculture - for instance, in cultivating vineyards and gardens. They are used in the construction industry for example, when assembling bridges, towers and high-voltage power lines and, of course, for transporting cargo and passengers. As soon as I see a helicopter on the ground or in the air, my mind goes back to the time when the foundation was laid for aircraft which had no need for airfields.

I recall 1928, the eve of the anniversary of the Great October Revolution, Engineer Nikolai Kirillovich Skrzhinskii and I submitted a proposal to the Central Soviet of the OSOAVIAKhIM (Society for Assistance to the Defense Aviation and Chemical Industry) of the USSR to build, in our spare time, with an autorotating propeller. We later thought up a Russian term for it - Vertolyot, forming it from two words, "vertitsya (turn)"and "letayet (flies)."

Our proposal was accepted. Once we had started working, difficulties appeared. However, they did not deter us. We were constantly aware of the warm support of such prominent aviation figures as Pyotr Ionovich BARANOV, Chairman of the Aviation Section of the Central Council of the OSOAVIAKhIM of the USSR and Commander of the Red Air Fleet, Valentin Anan'yevich ZARZARA, Chief Inspector of the Civil Air Fleet, and other comrades who had done much in the field of domestic aircraft production.

The condition of the civil aviation of that time left much to be desired. It is sufficient to say that it consisted of only ten passenger airplanes in all - six-seater "Junkers" - JU-13's with

185 hp engines. With a crew of two, these airplanes could take only four passengers. The planning and construction of the first Soviet helicopter, which we called the "Krasnyy Inzhener" (Red Engineer), had great historic, social and technical significance against this background.

The historic significance lay in the fact that the idea of creating a rotary-wing aircraft, already conceived during M. V. Lomonosov's life, found embodiment only under Soviet rule. On 25 Setpebmer 1929, the KASKR-I "Krasnyy Inzhener" helicopter lifted into the air for the first time and flew nearly 200 meters at an altitude of one and a half to two meters. Even though this was a short flight, it began a new era in the history of the development of Soviet aviation equipment.

In speaking of the social significance of the experiment, one should note the unaccustomed vigor with which the creative capabilities of our country came to be revealed, under the influence of the social reforms brought about by the victory of the Great October Revolution. Despite limited material and technical resources, young enthusiasts boldly set about solving the complex task, working inspiredly and without a thought of gain other than for their socialist Motherland.

The technical significance of the experiment was that it amounted to predetermination of the development of Soviet helicopter construction. Hinged fastening of the main rotor blades was first employed in the Soviet Union on the KASKR-I and KASKR-II. This permitted the helicopter to be balanced in all modes of flight. As we know, hinge-coupled main rotors are mounted on all of our helicopters, even today.

The main rotor blades of the KASKR-I and KASKR-II had tubular steel longerons, wooden ribs and a linen covering. Blades of similar construction were used on many helicopters of domestic manufacture until recently.

Powered and unpowered flights in the autorotation mode were first mastered in our country on helicopters which we built. We note that even today helicopters make powerless gliding descents in the self-rotation (autorotation) mode. It is this capability which provides safety in case of an engine failure. The technical significance of the creation of the KASKR-I and the KASKR-II lies also in the fact that, thanks to the hinged fastening of the blades, which permitted translational flight to be mastered, the helicopters proved suited to the needs of the national economy and the defense interests of the country.

We had to work for quite some time on problems related to aerodynamics and on calculating the durability of both the entire helicopter and the main rotor. These fields were almost unstudied. We also developed methods for flight-testing the rotary-wing craft, bringing out certain peculiarities in comparison with fixed-wing aircraft tests. Work on the construction of the first helicopters served as a good training ground for contemporary, well-known helicopter builders such as M. I. Mili. He was then a student and the assistant to the mechanic on the airfield where the KASKR helicopters were tested. He served his apprenticeship in the KASKR Design Group of the OSOAVIAKhIM of the USSR.

I dreamed of designing aircraft while still a student in the Mechanical Engineering Department of the Tomsk Technological Institute. In my native country, in Irkutsk, I saw an aircraft aloft for the first time in 1920. It was, as I later found out, a prize English "Conbur" reconnaissance aircraft with a 130 hp French "Klerzhe" engine which had been captured from the British interventionists in Murmansk by Soviet troops. It was flown by a military pilot from the aviation detachment of the Fifth Separate Army which liberated Irkutsk from the last of the Kolchak bands. Soon the aircraft of the Fifth Separate Army were transferred to the East, and I left for Tomsk to continue my education. At that time there was not a single organization, or individual, for that matter, in Siberia, who knew the trend in aviation. But the idea of designing and building domestic aircraft was already firmly established in my mind. It was very depressing to me that our aviators were flying in foreign aircraft.

I read and studied everything related to aviation. Then, one day in 1922, I received from my relatives in Moscow, a small brochure published by our Trade Delegation in Berlin. It was called the "Junkers Duraluminum and All-Metal Aircraft." From this brochure, I learned of the existence of duraluminum and of the application of this light and durable alloy by Professor Junkers in German aircraft building. This was a revelation for me. At that time I did not know that, in October 1922, the Kol'chugin Works of the State Nonferrous Metals Industry had already produced the first batch of the metal, called "Kol'chugaluminum."

Having finished at the Institute in 1923, I went to Moscow and got a job as a laborer-motor mechanic at the Junkers "IFA" Concessive Aviation Plant which was located in Fili. Of course, the first months of independent work were difficult. Every day I had to make the long trip from Vsekhsvyatskiy, where I lived, to Fili and back (the transportation system was poor at that time), and evenings I studied aviation theory. To this day I recall with satisfaction the remarkable production school I attended at the plant. It was here that engines were repaired and tested, fuselages were riveted, and the controls and equipment were assembled. A thorough knowledge of all of this was necessary.

Having accumulated practical knowledge at the plant and having learned aviation theory, I went to work in the Central Airplane Shops of "Dobrolyot" (the predecessor of "Aeroflot"). I spent two years in organizing complete overhauls of Junkers all-metal aircraft. But I lived with my dream of becoming an aviation designer. And this dream truly came closer to realization when I was offered a job in the Naval Aircraft Experimental Design Bureau, headed by D. P. Grigorovich, the famous Soviet aviation designer. It was here that I became acquainted with my future collaborator N. K. Skrzhinskiy, who had just graduated from the Kiev Polytechnical Institute.

Nikolay Kirillovich's industry, self-discipline and accuracy in working impressed me. We became close friends. Quite frequently we looked through domestic and foreign technical journals together. Ideas of creating something new, something which could advance Soviet science and technology, were born in our conversations. We became interested in rotary-wing aircraft, differing from ordinary aircraft in take-off, flight and landing features.

Two types of rotary-wing aircraft, at that time called helicopters or autogyros both here and abroad, were in existence in 1928. In principle, these machines could fly in any direction, take off vertically, hover, turn in place, and descend vertically. Their main rotors had a so-called rigid blade seal on the collar. This permitted only the blade mounting angle to be changed. The spatial position of the axis of the blade relative to the rotation axis of the rotor was not changed. The number of rotors and their mutual arrangement were determined by balancing the reactive moments of the bearing system.

Many helicopters were built in various of the countries, single-rotor, twin-rotor, coaxial, twin-rotor with lateral arrangement, twin-rotor with longitudinal arrangement, and multi-rotor. All these machines now seem to be strangely shaped and complex. But at that time, when design forms were being sought, they even seemed perfect.

The helicopters had a maximum range of 1,100 meters, flight altitude of three to four meters, a speed of ten kilometers an hour and a flight duration of 10.2 minutes. Helicopters could rise no higher for two basic reasons. First, the amount of lift developed was less than the weight of the apparatus, the result of the poor aerodynamic qualities of the main rotor; regardless of high engine power, helicopters only flew in an "air cushion" zone where the increase in lift was 15-20%. Secondly, no safety features were provided in case an engine quit, i.e., powerless glide in the rotor autorotation mode had not been developed. We also failed to increase flight speed because when we did, vibrations of an unpermissible amplitude occurred.

Of all the then existent rotor flying apparatuses, our attention was drawn to the design of an apparatus with one autorotating main rotor, which had been drawn up by the Spaniard Cierva. However, at this point, it is relevant to note the following.

The possibility of coming up with a stable main rotor self-rotation (autorotation) mode in an oblique stream and of assuring stable lift in this mode was made evident in the early 1900's in the Kuchinsk Aerodynamics Laboratory under the leadership of Professor N. Ye. Zhukovskiy. In fact, this idea was the basis of the apparatus which Cierva created. A conventional aircraft wing was replaced with an autorotating propeller. The result was an aircraft with an engine-propeller group, as in a conventional aircraft, but with an autorotating propeller instead of a wing. In his subsequent designs, Cierva made a small wing to which a wide chassis could more easily be fastened and also ailerons for lateral control.

The rigid main rotor did not provide balance in forward flight on his first autogyros. There were accidents at high speeds and the designer was forced to seek a new means of balancing the craft. He made a hinged main rotor blade suspension arm.

The hinge-coupled main rotor impressed N. K. Skrzhinskiy and me as being the best prospect for rotary-wing aircraft.

...We created the small KASKR (Kamov-Skrzhinskiy) Design Group at a unit of the OSOAVIAKhIM imeni Desyatiletiya Oktyabrya Works (Tenth Anniversary of October). The office staff included some comrades who were younger and even less experienced than we were, but we were all obsessed with the idea of building the first Soviet autogyro whatever the cost. We were allotted 450 rubles to develop the design, do the necessary research, and prepare working sketches. By order of Ayotr Ionovich Baranov the components of a U-1 training aircraft, the then so-called Avro-504K aircraft which we were licensed to build, were placed at our disposal.

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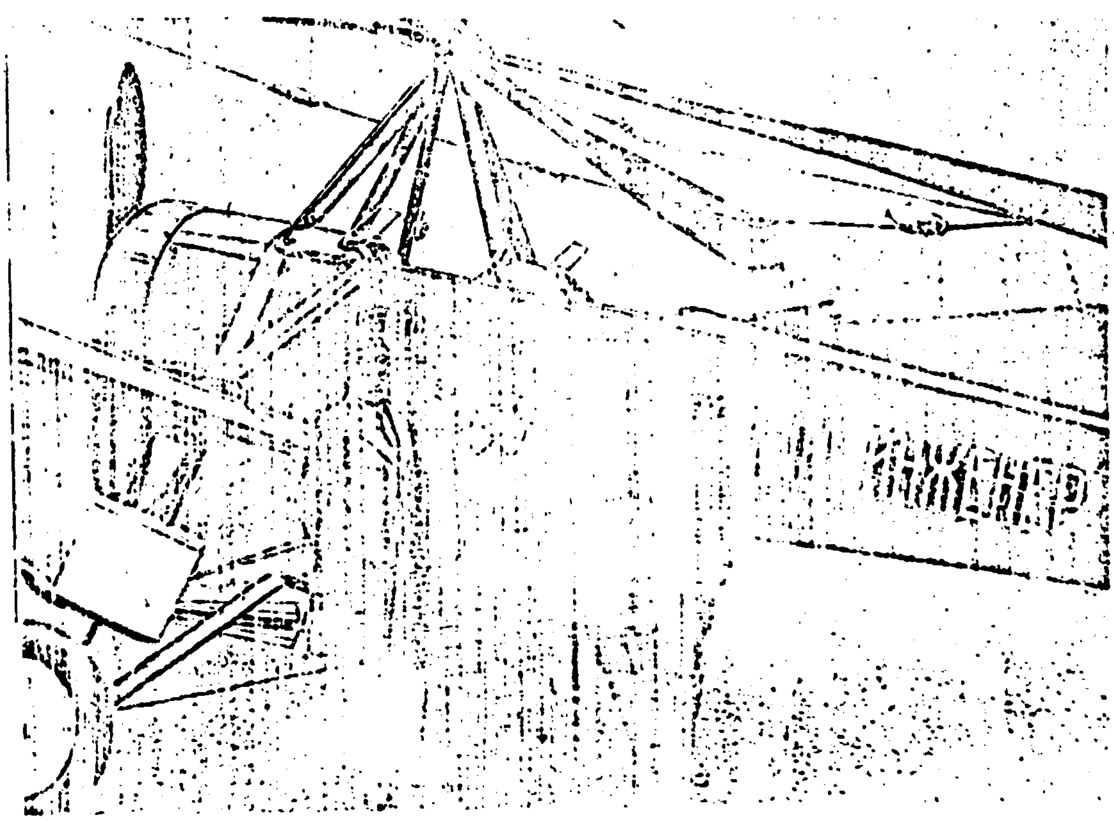
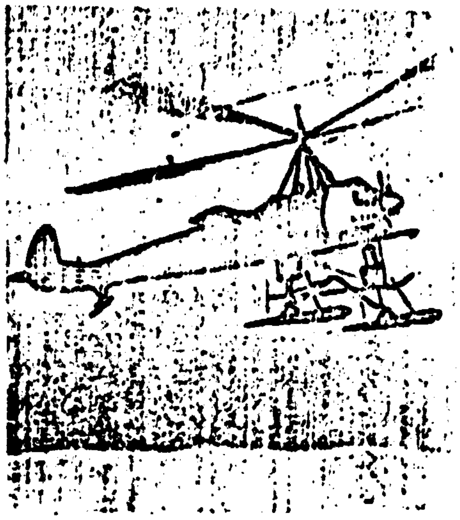


Before the first flight of the KASKR-helicopter. Left to right: N. Il Kamov, N. K. Skrzhinskiy, I. V. Mikleyev, E. A. Kreyndlin, A. F. Drakevich.

Nikolai Kirillovich and I decided to do everything jointly, to form the invention together. I took the organizational problems upon myself.

Work distribution was such that N. K. Skrzhinskiy was to design the blade and wing and introduce changes in the power plant. I had to make the main rotor collar, the component longeron of the blade with a telescopic connecting tube, a lateral rotor control mechanism, and a chassis capable of a high degree of shock absorption.

An extremely strict working regimen was established. It began at 1800 after completion of the normal day's work and finished at 2400 hours; on Sundays it lasted from 1000 to 2200 hours. In ten months we were able to complete the design and defend it, produce the working sketches and build the helicopter.



KASKR-II helicopter in flight

As was to be expected, the planning proved to be very difficult. Everything had to be done for the first time and the specialists to whom we should have been able to turn for advice were not available. I remember making five variations of the rotor collar, working out its body design form five times, and an equal number of times working out the horizontal and vertical hinges of the blade suspension arms. I calculated the collar bushing. Lengthy reflection on the dynamic durability of the longeron tube joints led me to the creation of an improved joint. What has now become the ABC's of helicopter construction was then only just starting to take shape.

At the "Aviarabotnik" Works our ideas attracted the interest of a number of comrades who willingly gave us help in building the helicopter. I remember the exceptionally conscientious work of aviation mechanic Emmanuil Anisimovich KREYNDLIN (now a retired major), who was attached to our design group. We made special chrome-molybdenum longeron tubes for the blades and riveted them with steel rivets.

...I remember the overcast day of 1 Setpember 1929. The helicopter was taken out through the factory gate to the airfield and positioned in with the wind blowing from tail to nose. Unfortunately, we failed to note this. As a result, the blades began to turn with the tail, not the nose forward. We silently watched this unexpected turn of events and did not know what to do.

Having survived this shock, we stopped the rotor and then decided to crank the rotor manually in the proper direction - nose forward. After several revolutions, we were overjoyed, understandably so, to see the rotor gathering speed in the right direction. But...our joy was premature. Because of the wind, which was blowing into the tail of the helicopter, the rotor, placed at a highly unfavorable angle of attack, overloaded the tie-down cables and one of them broke. At this point, the blades changed their spatial position sharply and dropped. But then the wind abated and the rotor began to turn more slowly. Horrified, we all expected to see the six-meter blade hit the fuselage. In this touchy situation there was nothing we could do; we could neither approach the machine nor stop the rotor. We mentally counted off the minutes... hearda crack, and the bladehit the fuselage, hurling the tail of our helicopter aside.

As distressed as could be, we took the helicopter to the factory. But we now knew how to place the helicopter in relation to the wind and how to crank the rotor prior to flight. We also understood that the tie-down braces had to be strengthened.

After repairs had been completed, we decided to conduct the first straight-line flight on the evening of 25 September 1929, when there was slight headwind. Ivan Vasil'yevich Mikheyev, a "Dobrolyot" pilot, sat in the forward cabin of the helicopter and I sat in the rear cabin. N. K. Skrzhinskiy got up on the wing and cranked the main rotor, energetically pushing each of the blades passing over him. Mechanic E. A. Kreyndlin started the engine with the propeller.

When rotor revolutions finally reached 35 to 40 per minute, Nikolay Kirillovich jumped off the wing. I. V. Mikheyev accelerated the engine and the machine started forward, picking up speed. Rotor revolutions built up quickly. When 90 rpm were reached, the helicopter broke away from the ground. I glanced at the revolution indicator: it showed 120. The machine vibrated heavily...We flew at an altitude of two to three meters. In my excitement I could see nothing except the rotor spinning overhead.

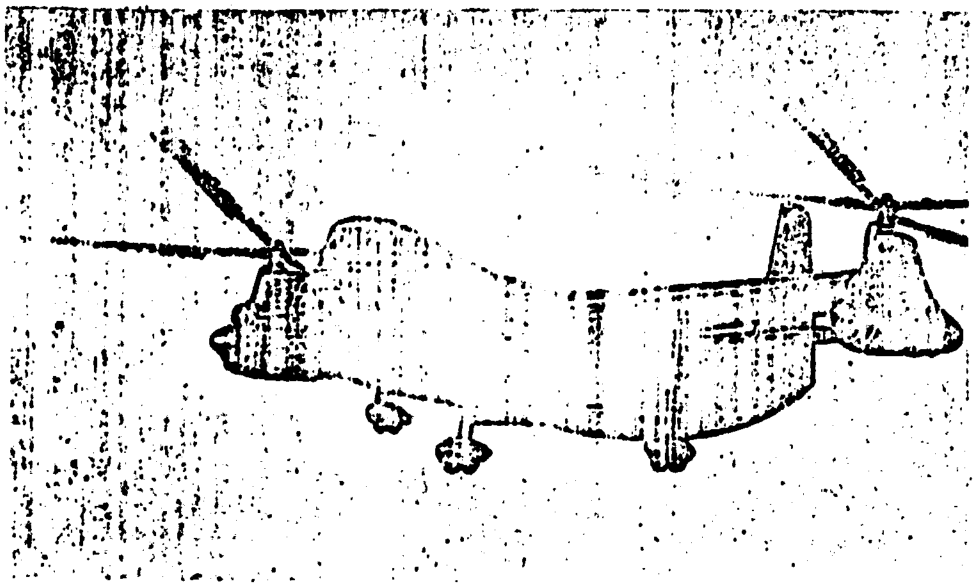
Soon, I. V. Mikheyev made a landing. It was a short run. The engine was cut. The helicopter was on the ground. N. K. Skrzhinskiy, E. A. Kreyndlin and the factory workers came running up. You should have seen how noisily we congratulated each other on our success.

...Several straight-line flights were made in the KASKR-I helicopter. The balance problem was still unsolved. We failed to take inertia forces acting on the blade into account. We also misunderstood the law of flywheel movement, so the helicopter listed. Therefore, when we tried to fly around in a circle on 12 October 1929, the helicopter flipped over, fell, and smashed up. Only the strength of the rotor block tubes saved I. V. Mikheyev and me from injury.

We had to find an explanation for what was a serious accident. Not until the spring of 1930 did we understand the error. We changed the lateral pitch of the rotor's axis and provided additional static lateral moment.

The improved KASKR-2 helicopter had a 235-hp "Titan" engine. The famous military test pilot and gliderman, Dmitriy Aleksandrovich KOSHITS, who was star of all the Tushino aviation shows of that time, did the summer testing. The Test Commission Chairman was A. A. KRAVTSOV, an engineer from the Scientific-Research Institute of the Administration of the Air Forces (NII UVVS), and members of the commission were D. A. KOSHITS, NII UVVS engineer A. I. Filin, mechanic E. A. Kreyndlin, N. K. Skrzhinskiy, and the author of this article.

GRAPHIC NOT REPRODUCIBLE



Combination helicopter with two turboprop engines.

Gradually increasing flight altitude and duration, the test pilot mastered steep-powered and powerless descents and vertical descents from great altitudes in headwinds. The helicopter now flew to an altitude of 450 meters and the duration of flight reached 28 minutes. D. A. KOSHITS and S. A. Korzinshchikov, then a NII UVVS test pilot, circling outside the boundaries of the airfield, made scores of flights.

P. I. BARANOV was often present at flights of the KASKR-II and gave useful advice. Kliment Yefremovich VOROSHILOV came to the airfield several times. Specialists including Professor B. N. Yur'yev, co-workers A. M. Cheremukhin, A. M. Izakson, I. P. Bratukhin and V. P. Lapisov of TsAGI, and many pilots and engineers of the Air Force observed the flights of the KASKR helicopters.

Members of the Soviet Government came to inspect the new aviation equipment on 21 May 1931. The KASKR-II, having made three circles at an altitude of 300 meters, landed almost vertically. They thanked us for the work we had done for the common good and recommended that we continue it.

The KASKR-II "Krasniy Inzhener" helicopter passed the test.

Almost 35 years have passed since that time. Aviation science and helicopter building have undergone enormous development. The ideas which came out of the KASKR Design Bureau with respect to methods of calculating, designing and testing and to the fields of helicopter usage have been expanded and enriched. Our beloved Motherland is now reaping the benefits of the labor of these early devotees of helicopter building.

Tekhnika i Vooruzheniye, No. 8, 1966, p. 19

THE INTRODUCTION OF A NEW MOTOR

The triumphant unveiling of the "Ispano 200 HP" engine by the "Gnom and Ron" Plant took place on 31 July 1920, at the "Gnom and Ron" Plant. The Russian "Ispano 200 HP" engine was built solely through the efforts of Russian workers, engineers and technicians and was made of Russian materials. The newly-built Russian "Ispano 200 HP" aviation engine came through its tests with flying colors.

(Journal "Vestnik Vozdushnogo Flota," (Air Fleet Herald)
No. 3-4, 1920)

Tekhnika i Vooruzheniye, No. 8, 1966, p. 20

The Soviet scientist Boris Nikolayevich Yur'yev, one of N. Ye. Zhukovskiy's most intimate disciples, made a great contribution to the development of helicopter construction. He developed the theory of the rotor, conducted comprehensive experimental research on the flight of helicopters of various designs under various conditions with the aid of flying models, and invented a helicopter control mechanism - an automatic pitch control, which, to this day, is installed in all the world's helicopters and is one of their most important components.

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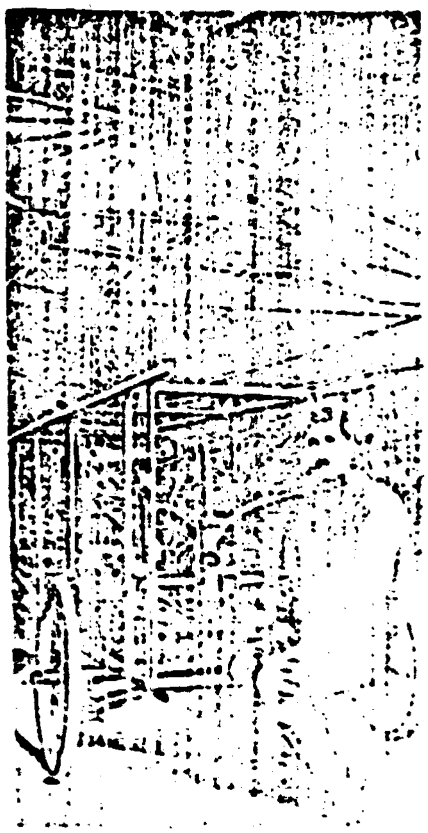


B. N. Yur'gev with the helicopter he made in 1912.

In the first years of Soviet rule, when a vast scientific-research aviation organization, the Central Aero-Hydrodynamic Institute (TsAGI), was created by direction of V. I. Lenin, Boris Nikolayevich became one of the leaders of a TsAGI section. Among other things, experimental-research in the study of the various main rotor modes was conducted here under his direct leadership. (The following clipping from Izvestiya, 16 August 1919, p. 1, is included, and reads)

RED AVIATION

Aviation Workshop

On Sunday, 17 August, a new Soviet scientific institute, an aviation workshop will open on the former Natruskin estate near Khodynskiy Airfield, on the Petrov Park Circle.

Established as part of the Flight Laboratory of the Moscow Regional Commissariat for Military Affairs, the aviation workshop will pursue the following tasks: first, to effect the broadest possible dissemination of aviation knowledge among Red Army soldiers and workers in the city of Moscow by arranging free lectures, excursions to the airfield, aviation factories, park-depots, etc.; second, to raise the level of technical knowledge among the workers in the aviation plants and in the air fleet...

The lecture section of the aviation workshop is presently making its first attempt at extending its activities into our province...

Apart from its agitation and educational activities, the aviation workshop's work will be directed primarily towards raising the level of technical skill of workers in the aviation factories and the air fleet.

With this goal in mind, an aviation workshop glider class is being established for acquainting people with aviation practices. The glider class will have an auditorium with a slide projector, a light workshop where students can build gliders themselves, a glider flight area and other auxiliary facilities such as a library, reading hall, gliding museum, etc., so as to accomplish the established tasks of communicating primary information on the history, elementary theory and techniques of aviation. The glider class lectures will be given every evening when all workers and employees are free from their normal occupations.

The teaching method in the aviation workshop will consist mainly of learning by seeing and by doing, which will no doubt allow the students to learn more quickly.

Tekhnika i Vooruzheniye, No. 8, 1966, p. 21

THE "KOMTA" TRIPLANE

In May 1922, testing was begun on the Moscow Airfield of a great twin-engine aircraft developed by the "Commission for Heavy Aviation," which was created in 1919 by TsAGI and known by the abbreviation "KOMTA." This product of collective creativity is a triplane. It was built very compactly and had much smaller dimensions than the "Il'ya Muromets," which served as the starting point for the planning of "KOMTA."

(Journal "Vestnik Vozdushnogo Flota" No. 12, 1922)

Tekhnika i Vooruzheniye, No. 8, 1966, p. 22

NIGHT FLIGHT EXPERIMENTS

Experimental night flights, the technical execution of which was entrusted to pilot-designer A. A. Porokhovshchikov, were carried out at Moscow Airfield last winter. The flight made by A. A. Porokhovshchikov from Zaraysk to Moscow in total darkness, during a heavy snow, and without signals or instruments for illumination, is of special interest in this series of tests.

(Journal "Vestnik Vozdushnogo Flota" No. 12, 1922.)

Tekhnika i Vooruzheniye, No. 8, 1966, p. 23

ONWARD AND UPWARD

That is the name of the newspaper of the Order of Lenin Red Banner Air Force Engineering Academy imeni Professor N. Ye. Zhukovskiy. The most important political events taking place in our country are dealt with at this Academy, life in the podrazdeleniye of the academy is recounted and experiences in the organization and conduct of training are presented. The newspaper also devotes its attention to creative innovations.

One of its issues is devoted to a conference of Academy inventors and rationalizers. Faculty and Department representatives tell of the successes they have achieved.

Faculty No. 3 has taken first place in the Academy for the past five years as a result of such work. This success is first of all explained by the attention which command and the Party committee give to the activities of the rationalizers. No less important is the fact that the Chairman of the Faculty Commission for Inventing, Engineer-Colonel A. A. OVCHINNIKOV, is one of the best rationalizers. A. A. OVCHINNIKOV and Engineer-Major V. S. PUGINSKIY were awarded VDNKh of the USSR gold medals and prizes for the development and application of logical diagram (network) methods for the planning of the training process. Other faculty rationalizers have also been decorated with medals of this type.

The rationalizers of another faculty have devoted their efforts to developing methods and devices for instrumental control of the condition of aviation equipment. A laboratory for control of engine operation is used on a training airfield. The rationalizers created and introduced a system of control and communication which increased the orderliness and accuracy of the execution of operations. An installation which permits making the various shapes needed for making visual training aids from cheap, synthetic, materials has been completed.

Rationalizer-operators have made modifications which simplify engineer-navigators' calculation and calculations of takeoff and landing characteristics in combat chast'.

Among the inventors are Doctors of Technical Sciences, S. M. BELOTSERKOVSKIY, A. A. KRASOVSKIY, V. A. PROTOPOPOV, S. A. ALEKSEYEV, V. A. VINOKUROV, V. P. SELEZNEV, Ya. S. ITSKHOKI, and others. Engineer-Colonel V. A. VINOKUROV, for example, has over 11 patents and the majority of his inventions have been put into practice and are found in the serial production of aviation equipment.

The newspaper is systematic in giving advice. For example, a column called "Rationalizer's Memorandum" has been introduced. The articles carried under this heading tell what a rationalization proposal is and how it should be formulated.

Tekhnika i Vooruzheniye, No. 8, 1966, pp. 24-28

CONTACTLESS GENERATORS

by

Major General of Engineers, Candidate of Technical Sciences, Docent D. KRIVOZUB and Candidate of Technical Sciences, Docent O. ZOLOTAREV

The attention of specialists is being drawn more and more to contactless electric machinery, which have many definite advantages over ordinary generators. What has caused this recent, increased interest in contactless electric machinery? In order to analyze this, we will discuss briefly the operational features of modern mobile electric power stations and electric aggregates.

Synchronous alternators with machine-type exciters and carbon voltage regulators have been installed in most low-power electric power stations and are now being installed in many others. The exciter is an electric motor in which electromotive force is induced and, with the aid of a commutator and brushes, is converted into a direct, accurate, pulsating emf. When the armature is rotated, one or several sections of its winding alternately disconnect from one of the parallel branches and connect to the other, during which the polarity at the brushes remains unchanged. These switchings are necessarily accompanied by sparking, which causes ionization of the air around the commutator, and this, in turn makes for further spark formation. Initially, when the brushes and the commutator are in good condition, this process is almost unnoticeable and there is no danger to the machine. A dirty commutator, poorly seated brushes and misalignment of brushes in the brush riggings will decrease the contact surface of the brushes on the commutator. The current density in the contact layer increases and, as a result, sparking is intensified. Roughness which has formed on the commutator surface also intensifies sparking. As a result, the brushes and commutator quickly wear out and the machine malfunctions.

Experience has shown that the basic cause of mobile electric power stations breaking down is malfunctioning of the commutating system. This is why very careful servicing and observation of the brushes and the commutator are required.

We also know that commutator and brushes are a source of strong radio noise. Designers have created many special devices in order to lessen these noises. However, only by the elimination of the source of the noise itself, i.e., of sparking, can solve the problem.

The carbon voltage regulator is an equally vulnerable device in electric power stations. Its basic element is the rheostat, which consists of carbon washers with rough surfaces. The washers are compressed by a spring which counteracts the electromagnet which is included in the circuit. Depending on the voltage delivered to it the pressure changes and, in turn, the contact surface of the washers changes, determining the resistance of the rheostat. However, when the washers are scorched, the carbon pole malfunctions and individual adjustment is required to restore it. A regulator in this condition is subject to jolting, and great attention must, therefore, be given to wear and tear.

The commutator machines and the carbon regulators in modern stations are being replaced with a static system which provides excitation, regulation, and stabilization of the synchronous alternator's voltage. Such systems have no moving parts, are made of semiconductor elements and electromagnetic amplifiers, and are distinguished by their high reliability. However, there are still brushes and contact rings in the alternators. Their use is undesirable in a number of cases and sometimes is not even permissible unless special measures are not taken.

Especially critical is the problem of eliminating sliding contacts in machines operating in a rarefied atmosphere. This is explained by the fact that, with an increase in altitude, the service period of the brushes sharply decreases. Moreover, it is even shorter in machines with collector rings than in commutator machines. The fact is that under ordinary conditions a lubricating layer arises between the brushes and the collector rings (commutator) when the rotor is turning. Moisture, the amount of which decreases rapidly with altitude, is necessary to form the lubricating layer. For example, the moisture is approximately 360 times less at an altitude of 10 kilometers than at sea level. Special cooling and humidifying systems are made and special brushes are used to improve working conditions for the sliding contacts in a rarefied atmosphere.

Commutator machines should not be located on premises where danger of explosion exists, or in a corrosive medium, where the contacts quickly deteriorate.

Thus, all of the peculiarities which arise in the operation of electric generators under various conditions has caused the specialists to reject conventional commutator machines and switch to contactless power sources. It should be noted that in and of itself, the idea of contactless electric machines is not new. Squirrel-cage induction motors, synchronous machines with permanent magnets in the rotors, and inductor synchronous machines have long been used in engineering. Contactless synchronous motors, which combine the popular qualities of synchronous motors and the simplicity of arrangement and operational reliability of the squirrel-cage induction motors, have found practical use. It has only been in the past ten years that contactless generators have come to be employed. They are now used primarily in various transport media where the inspection and servicing of the machines (changing the brushes, for example) is impossible during movement, and either undesirable or difficult at stop. Contactless generators for passenger trains, buses and trucks are produced by Soviet factories.

Machines with rotating rectifiers and generators with spur-shaped poles are of definite interest among the great many diverse types of contactless electrical generators.

A synchronous motor is usually used as the exciter for synchronous alternators with rotating rectifiers. The alternator and exciter have a common shaft (Figure 1). The rotor carries the exciter armature winding and the winding for exciting the alternator. The rectifiers, through which the alternator excitation winding is fed, rotate with them. Two windings, the three-phase alternator armature, and the excitation winding of the exicter, which is fed through the rectifier, are located on the machine's stator. The system is equipped with an automatic voltage regulator.

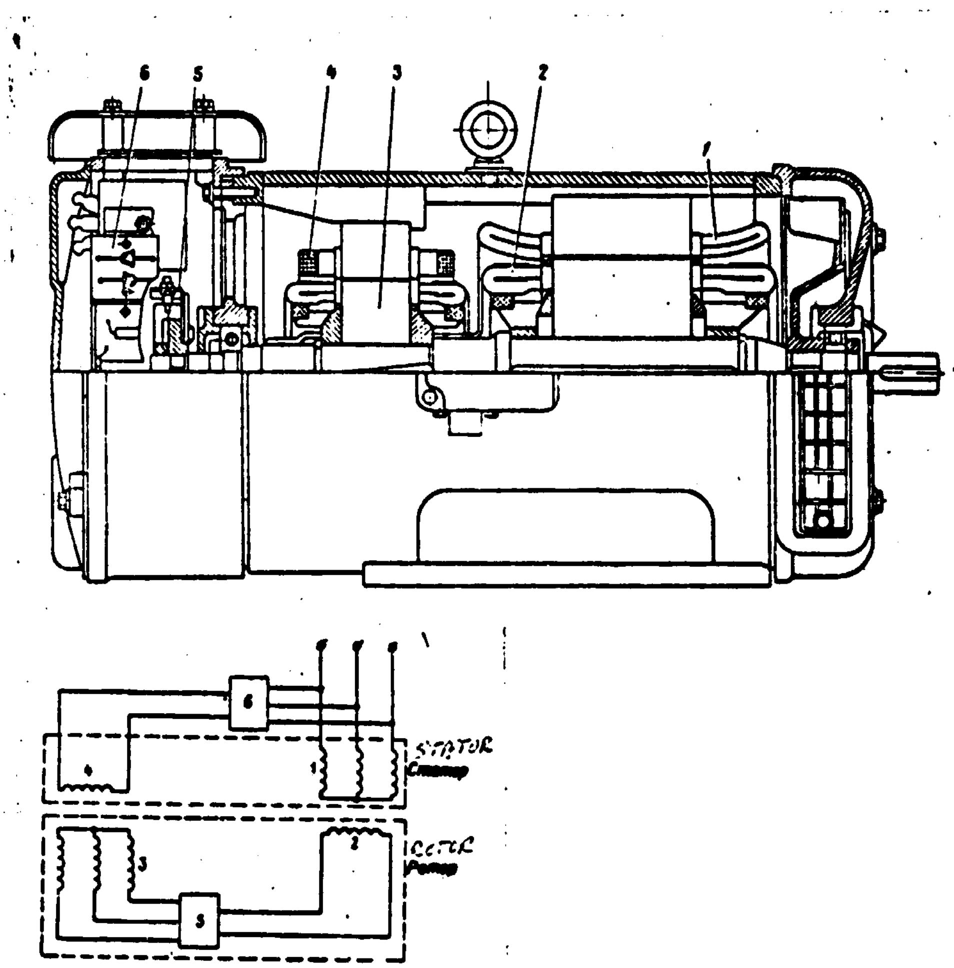


Figure 1. Contactless Synchronous Alternator with Rotating Rectifiers.

1- three-phase winding on alternator armature; 2- alternator excitation winding; 3- exciter armature; 4- exciter excitation winding; 5- exciter rotating rectifier; 6- stationary rectifier.

The self-excitation process in the alternator occurs in the following manner. An emf, induced by the residual magnetic flux, occurs in the windings of both armatures (alternator and exciter) when the rotor begins to turn. A small current, which in turn increases the induced emf, flows in the excitation windings. The process continues until a condition corresponding to its parameters is reached in the machine. An inductor motor can be used as an exciter instead of a synchronous machine.

Machines of this type are highly reliable, do not cause radio interference, and can operate safely where danger of explosion exists. Their shortcoming is the relative complexity caused by having two windings and the rotating rectifiers in the rotor.

There are a great many different designs of synchronous alternators with spur-shaped poles. The machine with permanent magnet excitation is the simplest in design. The rotor is a cylinder, magnetized along the axis and pressed onto the shaft. Two forged collars with pole "spurs" made of soft steel are pressed onto this same shaft (Figure 2). One collar faces the north, the other the south pole of the magnet, which causes the "spurs" to be attracted to each other. The stators of machines with spur-shaped poles are no different from conventional ones.

The design of the machine with permanent magnets is simple; it has no excitation winding. However, this complicates voltage regulation. This is one of the basic shortcomings. Machines with permanent magnets operating at a frequency of 50 cps take smaller electromagnetic loads, and their size and weight is greater than machines with electromagnetic excitation. This is where the complication of a design employing electromagnetic excitation comes in. In addition to the two pole forgings, the rotor carries the excitation winding, wound on a core and connected to a DC source (Figure 3).

True, one cannot really call a machine such as this contactless because the current is fed through collector rings and brushes to the excitation winding. It is only natural that its inherent defects are those found in conventional machines with sliding contacts. However, there are a number of advantages. The excitation winding coils are of a simple, circular shape, and making and securing them in place is considerably simpler than in machines with clearly defined poles, while considerably less insulating materials are used. The technique is particularly simple when the coils are made of anodized aluminum foil. Nonferrous metal is saved because the weight of the winding is reduced. Also important is the fact that in machines with spur-shaped poles not more than four excitation winding coils are required, whereas, conventional machines require a number equal to the number of poles.

The magnetic induction lines in these machines have a distinctive shape. Issuing from a pole of one polarity, N for example, they pass through the air gap in the stator (sections a, b, c), enter the pole of opposite polarity, and close around the excitation winding coil through the core (sections c, d, e, f, a). If the magnetic induction lines close in a plane perpendicular to the longitudinal axis in the conventional synchronous alternator, in a machine with spur-shaped poles they only pass through in this plane in the section a, b, c. In the c, d, e, f, a, segment they are nearly a spiral. This distribution of the useful magnetic flux, relative to the poles, remains unchanged for a stationary as well as a rotating rotor or excitation winding.

Moreover, flux dispersion occurs. One of the $\phi_{s\delta}$ closes through the shaft, the other between the lateral surfaces of the adjacent opposite poles. When the rotor rotates they do not intersect the stator winding and no emf is induced. An increase in the size of the magnetic circuit is necessary.

As has already been said, collector rings are necessary to deliver current to the excitation coil located in the rotor. The coil must be installed in a stationary position in order to avoid using them. Today, contactless synchronous machines with cantilever rotors (Figure a on the back cover)•f have found application in automobile building and in other branches of engineering where dependable, low-power alternators are required. The excitation winding in these machines consists of one coil wound on a rigidly secured core. The two pole systems in the rotor are interconnected and insulated from each other magnetically. The relationship of stator length to its diameter must not be greater than 0.4 for rotor design similar to this.

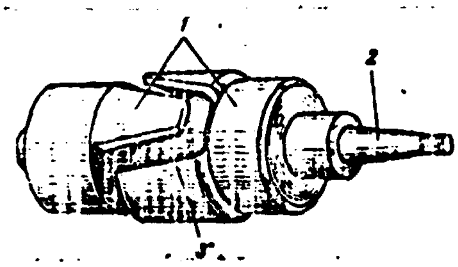


Figure 2. Rotor of Alternator with Spur-Shaped Poles.

1- collar with pole tips ("spurs"); 2- shaft; 3- magnet.

Unlike conventional machines, there is not one air gap, but two, in the alternator with spur-shaped poles and cantilever rotor. The first, δ_1, is formed between the rotor and the stator, and the second, δ_2, is formed between the rotor and the core. The magnetic induction lines close, without leaving the stator. The short length of the magnetic circuit is the advantage in these machines, called machines with internal magnetic circuits. However, the cantilever rotor can only be used in small alternators. Synchronous

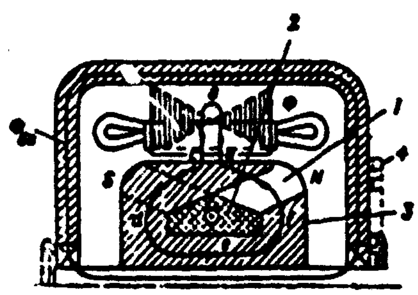


Figure 3. Alternator with a Rotating Excitation Winding.

1- rotor pole; 2- excitation winding; 3- core; 4- sliding contacts of excitation winding.

• Translator's note: The reference is to the back cover of the original document, reproduced and included as Figure 5.

machines with external magnetic circuits (position b) are used to obtain high power. The excitation coils too are stationary, symmetrically located relative to the poles and the stator, surrounding the rotor, rather than being inside it. The lines of magnetic induction interlock with the stator winding, just as in the machine just discussed. But they close around the stator. Since the magnetic flux closes through the frame and the lateral shields, they are made of magnetic material. The rotor is sometimes made multipositioned and a part of the excitation winding is wound near the front parts of the stator winding. This makes for a more compact machine.

In machines with external magnetic circuits, the excitation winding is placed at a considerable distance from the active surface of the poles facing the stator. Therefore, the magnetic flux passing through the external magnetic circuit is a much more useful current, inducing an emf in the stator winding. The cross section and size of the external magnetic circuit must be increased and, accordingly, the weight of the machine, and this can, in certain cases, result in the weight exceeding that of a conventional machine by 30%. However, there are many advantages to compensate for this shortcoming. First, synchronous machines with external magnetic circuits are distinguished by their high operational reliability, because there are no sliding contacts and rotating windings. Second, the technology of producing excitation windings is very simple. The weight of the winding, and its heat and inductive losses are considerably less than in a salient pole machine. Thus, the weight and the losses in the excitation windings of contactless alternators are 1.6 times less than in the conventional four-pole machine for the same power rating, and 2.7 times less than in the six-pole machines. Alternators with external magnetic circuits can have quite high power ratings, measured in the tens of kilowatts. The machines can be used as synchronous motors which are the equal in reliability of squirrel-cage induction motors, and can run at a power factor equal to one, as well as with leading current.

Multipile machines with repeated use of the magnetic flux are made in order to decrease the cross section of the external magnetic circuit. A machine with three stator piles and a common winding, and three spur-shaped pole systems, through which the magnetic flux flows in series is shown in Figure 4. This permits the weight of the magnetic circuit and the number of additional air gaps to be decreased. However, the path via which the magnetic flux closes is lengthened, and the magnetizing force of the excitation winding is increased.

It is evident from this short summary that, in the course of solving the problems of creating contactless machines, a whole series of new design solutions have been found which have considerably increased the reliability of electrical generators. On the basis of the experience gained in the operation of contactless machines, we can conclude that their role in power plants will increase.

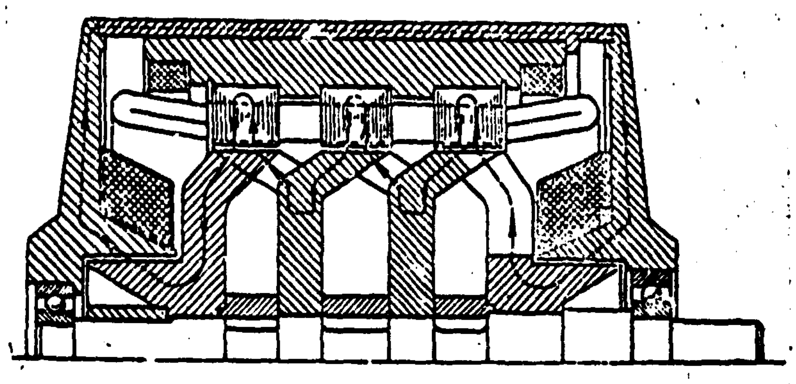


Figure 4. A Multipile Contactless Alternator.

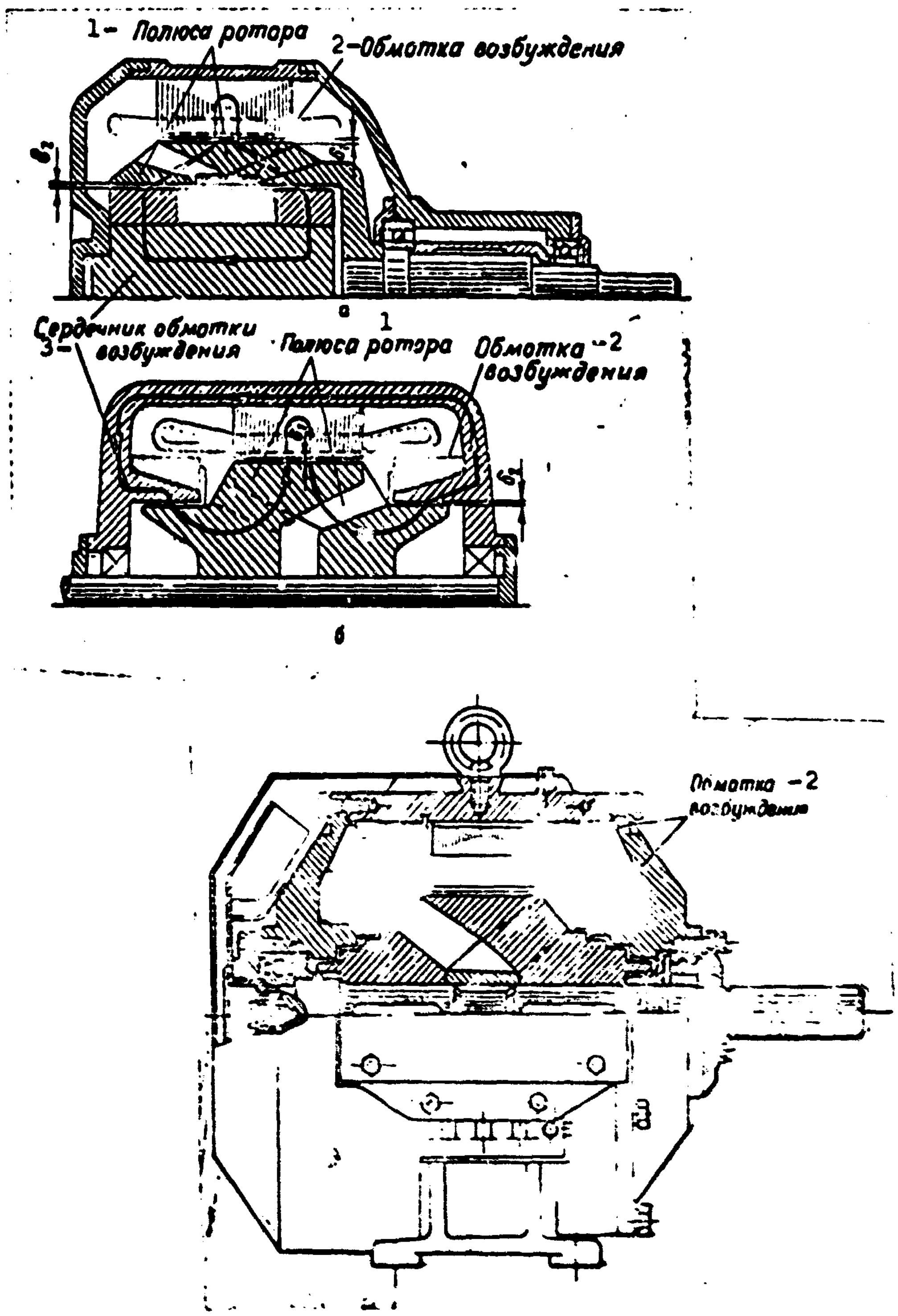


Figure 5. Back cover of original document referred to in text.
1- rotor cavity; 2- excitation winding; 3- excitation winding core.

Tekhnika i Vooruzheniye, No 8, 1966, pp. 29-33

HYDRO- AND PNEUMOELEMENTS

By Engineer-Colonel, Dr. of Technical Sciences A. GORELIK

In the automatic control systems of airplanes and rockets, tanks and ships, elements whose principle of operation is based on the usage of the energy of compressed liquid or gas are widely used as amplifying and actuating elements. These hydraulic and pneumatic amplifiers, in comparison with other power amplifiers such as electric motors, have higher dynamic qualities. They are more reliable, simpler and more compact and have high output power with small size. Hydraulic and pneumatic actuating elements or mechanisms also have a number of essential advantages over electrical devices. They have a wide range of smooth velocity variation, high power per unit of moving mass, simplicity, reliability, low cost and high dynamic properties. The energy of the liquid or gas can be transformed into mechanical energy of reciprocal or rotating motion without any special reducing mechanisms.

The most widely used hydraulic devices at the present time have the following basic parameters: liquid pressure in lines, 35-300 atmosphere; greatest liquid flow rate, 15-50 liters per minute; weight, 0.25-2.5 kg; weight per unit power 25-50 grams per horsepower; power amplification factors 60,000-300,000; time constant 0.01-0.001 sec.

Let us analyze the operation of hydraulic and pneumatic amplifiers and actuators.

The hydraulic amplifier is a device which amplifies signals arriving at its input from sensing elements of the automatic control system. It is also designed for movement of valves or other control devices of actuaters. Automatic control devices primarily use hydraulic amplifiers with throttle control (considerably more rarely, hydraulic amplifiers with jet control are used). They consist of two elements: one of them, the controlling element, receives the signal from the sensing element of the control system, transforms it, amplifies its power and sets the actuating element in motion; the other amplifies the signal and transmits it to the input of the hydraulic actuator.

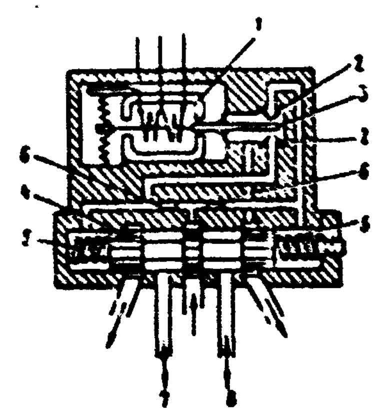


Figure 1. Hydraulic amplifier without feedback

The amplifier shown on Figure 1 is the most wide spread in hydraulic engineering. Its control element consists of an electromechanical converter I, whose input receives the signal from the sensing element of the automatic control system and two variable chokes (nozzles) 2 with gate 3; the actuating element consists of the distributing valve 4, bound on both sides by springs 5 and the two constant chokes 6.

The hydraulic amplifier works as follows. When there is no signal on the input of the electromechanical converter, the gate occupies a position such that the hydraulic resistances of the variable chokes are equal and the valve, in its initial position, closes the channels through which the pressure is fed to the input of the actuator mechanisms 7 and 8. As a signal arrives from the sensing element, the gate begins to move to one side or the other, depending on the sign of the signal. The hydraulic resistance of one choke is increased, that of the other is decreased. This causes a pressure drop in the spring cavities. The distributor valve is moved and opens one of the pressure channels, allowing pressure to go to the actuating mechanism.

With respect to their control method, hydraulic amplifiers are divided into open (without feedback) and closed (with feedback). We have just analyzed the operation of an amplifier with no feedback. It is simple in design and reliable in operation, but is inferior to amplifiers with feedback as concerns accuracy and stability of operation.

The simplest design is an amplifier with inflexible feedback, in the form of a transmitting arm (Figure 2). Then, when the distributing valve I is moved to the right under the influence of a signal, the liquid is fed through the right portion of the working cylinder 2 of the actuating mechanism. Piston 3 begins to move to the left, moving the body of the valve to the right through the transmitting arm 4 (inflexible feedback) until the channels are closed once more and the piston stops. Due to the negative feedback, the dynamic and static characteristics of the amplifier practically do not depend on the quality of the parts of the amplifier, changes in viscosity, coefficient of hydraulic resistance or quality of filtration of the liquid. In addition to the hydraulic amplifier circuits which we have analyzed, there are many others. Their principles of operation, however, are similar.

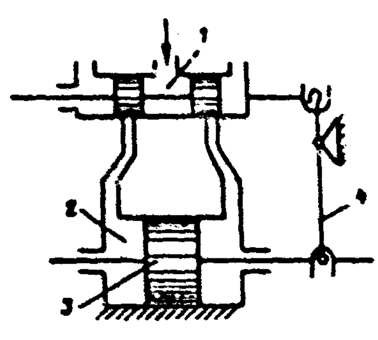


Figure 2. Hydraulic amplifier with feedback

<u>Hydraulic actuating mechanisms</u>, or servomotors, move control organs in the objects of automatic control. In airplanes, for example, such organs are the rudder and aelerons, in rockets - the fins and control motors, in piston engines -- the pitch of the propeller, in rocket motors -- the reactive nozzle.

In spite of the variety of designs, all hydraulic actuating elements consist of two elements -- the controlling element and the actuator. The actuators used are hydromotors (hydraulic motors), most often of piston type. The control elements are usually either chokes (valves) or jet tubes.

In an actuating mechanism with a hydromotor (Figure 3) the working fluid is forced by a pump into the central channel of valve box I. When valve 2, moved by the actuating element of the hydraulic amplifier, is displaced from the middle position to one side, the hydraulic fluid enters the corresponding chamber of the operating cylinder. The pressure drop causes the piston 3 to be moved, which moves the control organ as required.

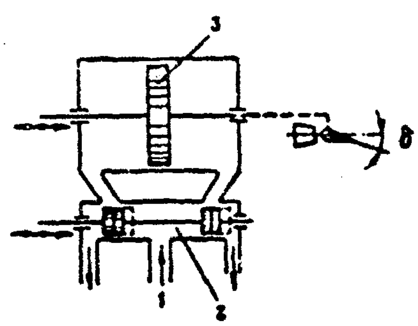


Figure 3. Hydraulic motor

In a hydraulic motor, the rate of movement of the piston depends on the amount of the displacement of the valve. This dependence is called the static characteristic of the hydromotor (Figure 4). The length of sector AB-the dead zone - is caused by the fact that it is difficult to produce a valve in which the apertures and plugs are of identical dimensions. In some valves, the plugs are made narrower than the apertures. Then there is no dead zone, but the operating fluid is always being gradually expended. When one aperture of the valve is completely opened, the rate of movement of the piston becomes constant and is the maximal possible.

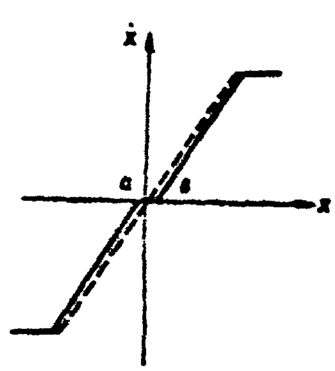


Figure 4. Static characteristic of hydraulic motor

The hydraulic amplifier and actuating mechanism are used in the system which controls the rate of rotation of a turbine motor as well (Figure 5). The rate of rotation changes as a result of rotating the blades of the variable pitch propeller. The control signal is composed of the signal from the centrifugal tachometer I, which signal is proportional to the rate of rotation of the motor and the signal of an electrical accelerometer, which signal is proportional to the angular acceleration. Due to this, stable and highly accurate control of the operation of the motor is provided.

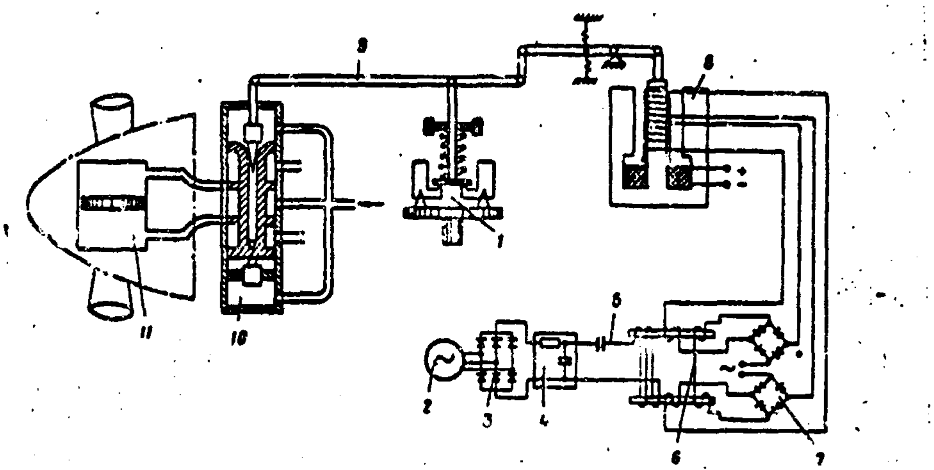


Figure 5. Plan of electrohydraulic rotation rate controller for turboprop motor

The accelerometer consists of an alternating current tachogenerator 2, rectifier 3, filter 4, differential circuit 5, magnetic amplifier 6, rectifier 7 and proportional magnetoelectric relay 8. The signals of the tachometer and accelerometer are added kinematically by levers. Displacement of lever 9, proportional to the control signal, causes movement of the valve in hydraulic amplifier 10, and the liquid enters the corresponding cavity of the hydraulic servomotor 11. This causes the rotation of the prop blades.

.hould also be emphasized that hydromotors have very small time constants, which can be ignored in practice, plus rather high efficiency, reaching 75-85%. Their deficiencies include: absence of remote operation, requirement for careful filling, characteristics which change with external temperature and pressure and, finally, the requirement for a source of hydraulic pressure.

Actuating mechanisms with pneumatic motors are used in rocket control systems, primarily for rockets with brief flight durations (on the order of a few minutes). These rockets usually contain cylinders with compressed gas which is fed through a reducer to the actuating mechanisms controlling the rocket.

The design of pneumatic motors has two variants: with gas distributor valve and with jet tube. A pneumatic motor of the first type operates in the same way as a hydraulic motor. A plan of a pneumatic motor with jet tube is presented on Figure 6. When the jet tube I is in the neutral positions, which corresponds to 0 value of the difference signal,there is no pressure drop in the chambers of cylinder 2 and piston 3 remains in its initial position. The control organ remains in a neutral position.

If the parameter being controlled deviates from its assigned value, i.e. a different signal arises, the jet tube is turned by value Y, proportional to the value of the difference signal. Pressure P_1 becomes unequal to pressure P_2 and, under the influence of the pressure drop $\Delta P = P_1$

minus P_2, the piston is displaced by the distance X, and the control organ of the object, such as a rudder, -- by the value σ. The thrust torque created by the control organ causes the object to occupy an assigned position. The difference signal becomes equal to 0, and the tube is returned to the neutral position.

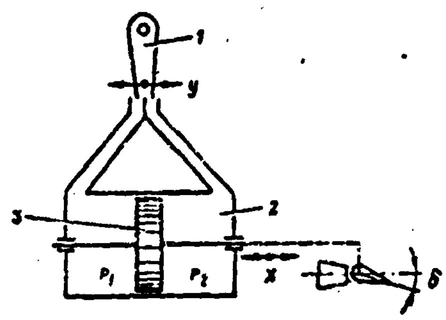


Figure 6. Pneumatic motor with jet tube

These are the mechanisms which are most frequently used in automatic control systems.

Tekhnika i Vooruzheniye, No 8, 1966, pp. 30-33

LIFE FOR THE PEOPLE

G. NAGAYEV

Vasiliy Alekseyevich Degtyarev was born in Tula -- the town of the famous master gunsmiths who made Russian guns famous throughout the world. In his early childhood, he loved his grandfather the blacksmith and was attracted to blacksmith and shop work; but he expected to follow the usual path for youngsters from working families. At the age of 12, his father sent him to the plant. This was in 1891, when the production of the famous Mosinskiy rifle was begun in the shops of the plant. Degtyarev, who worked at a Sharmanka -- a tool for testing rifle springs -- was privileged to see S. I. Mosin in the shop,to hear his conversations with the foreman and workers. Vasiliy felt great admiration for the designer.

Studying the Mosinskiy rifle to the finest detail, Degtyarev secretly dreamed of working on the invention of a new, even better weapon. But he could not even speak of this at the plant. In those days, the road to creativity was firmly closed to inventors from the people. Degtyarev thought of asking Mosin for help, but he was transferred to Peterburg, then named as head of the Sestroretskiy Weapons Plant. The opportunity of working as a real inventor was presented to Degtyarev only many years later.

When he was in the service, stationed at Oranienbaum, working in the weapons shop of the officers infantry school, Degtyarev became familiar in detail with a new automatic rifle, which had just arrived from abroad. At the firing range he met a few foreign inventors: Browning, Madson and Swartzlose.

During the Russian-Japanese War, many foreign inventors of weapons and weapons fabricators came to Russia, hoping to obtain large profits. The American Browning attempted to sell Russia his automatic rifle. Once, during firing range testing, the rifle refused to fire. Browning took it into the shop and begin to repair the damage. The work didn't go well and Browning became nervous. Finally, using an interpreter, he asked Degtyarev to help him. Everyone stopped working and begin to watch Degtyarev. Vasiliy Alekseyevich rapidly took the rifle apart, found the damage and fixed it easily. Then, with surprising ease, he reassembled the unfamiliar rifle and gave it to Browning. Browning was amazed by the quickness of the Russian master. He thanked him and hurried off to the firing range.

"But the American's rifle will be rejected anyway," Degtyarev said to the workers around him.

"Why?"

"It's extremely complex. The parts are small and weak... It won't work..."

And that is how it happened. The rifle was rejected.

His encounter with Browning convinced Degtyarev that the foreign rifles were still far from perfect and he wanted more then ever to create his own, Russian automatic rifle.

In 1906, Degtyarev met V. G. Fedorov, who invited him to work on the first Russian automatic rifle. Degtyarev gladly agreed. He put together a few samples of the Russian automatic rifle from the drawings made by Fedorov. He had to work under difficult conditions, in the small workshop of the firing range, which didn't even have a decent lathe. But his long years' work was crowned with success. In 1912, earlier than in Germany, France or America, the Russian automatic rifle of the Fedorov system passed the commissioners, then firing range tests. By the beginning of the First World War, all the experimental works on creation of new weapons were completed, and Fedorov was sent to the front.

Degtyarev, who learned a great deal in his 6 years of work with V. G. Fedorov, begin working on the creation of a new automatic carbine. He worked long hours, at home, using a foot operated lathe and completed his carbine in 1916. When he returned from the front, Fedorov praised Degtyarev's invention highly.

Degtyarev's talent actually developed after the October revolution. The talented designer was given all the conditions necessary for creative work. Together with Fedorov, he organized the first design bureau in the Soviet Union and begin working on the creation of new automatic weapons. In 1924, on assignment from M. V. Frunze, Degtyarev invented the DP hand carried machine gun (DP stands for Degtyarev Infantry). In battles with the Japanese aggressors in Khalkhin-Gole, in the war with the Fins and in the Second World War, this weapon won unfading glory. The machine guns of the enemy were not able to compare with it.

This first great success inspired Degtyarev to new creative daring. In the 1930's, he created aviation and tank, large calibre and heavy machine guns, several models of automatic rifles and carbines. The name Degtyarev became widely known in our country. Many young designers studied under him; the hardest art is the art of creating new types of weapons.

The Soviet Government placed a high evaluation on the services of V. A. Degtyarev; he was the second person in our country to receive the award "Hero of Socialist Labor."

In autumn of 1941, when the Fascist tanks were moving toward Moscow, Degtyarev created a new, sorely needed weapon -- the antitank gun. In the capable hands of the Soviet soldiers, this gun was a powerful force obstructing the Fascist armored machines. Soviet troops wrote friendly letters to Degtyarev from the front in which they thanked him from their hearts for creating the wonderful weapon. This close friendship and living communication of the designer with the soldiers and the officers aided him in locating and eliminating deficiencies in his systems, some so small that they could be noticed only by people actually fighting with the weapons.

For Degtyarev, creative labor was a great delight. His love for his country and his concern for his country made this labor inspired. Even when serious illness confined him to bed, he continued working on perfection of one of his inventions, for which he received a state prize posthumously.

In the years of the Soviet state, the talented Russian native Degtyarev grew from a semiliterate worker to a famous designer, social and state activist, Doctor of Technical Sciences, Deputy of the Supreme Soviet of the USSR, and a world famous inventor. His life and selfless service to his country will be an example for Soviet people forever.

Tekhnika i Vooruzheniye, No 8, 1966, pp. 34-35

...UP TO THE RIFLE OF S. I. MOSIN

E. ASTVATSATURYAN,
Scientific Collaborator of Weapons Department State Historical Museum

Rifled weapons appeared in the 16th Century. The rifling in the barrels was at first straight, with up to 32 grooves, then it became spiral shaped with the number of grooves being reduced to 8-10. The range of shooting with this sort of barrel was 400 meters -- almost twice the range possible with a smooth bore. Rifled weapons were difficult to load; the bullets had to be rolled about in an oily rag for 5 minutes and forced into the barrel with a ramrod. This type of weapon was therefore called a weapon "with tight driving of the bullet into the barrel". The cavalry was armed with this sort of weapon up to the middle of the 19th Century, as they required only one shot "in reserve" (they would not have been able to reload the weapon on horseback anyway).

In the middle of the 19th Century, new systems of rifled weapons appeared in Western Europe. The best of these -- the so called Littich stutzer -- was taken as the standard weapon of the Russian Army in 1843.

After the Crimean War, the Russian Army begin to carry a new type of rifled weapon of smaller calibre -- 6 lines. The reduction in calibre was due to the fact that the cylindrical bullets used were heavier than round bullets and caused a stronger recoil.

Practice showed that the firing rate of the rifled weapons -- 2 rounds per minute -- was clearly unsatisfactory. In order to load the rifle through the muzzle, a soldier had to stand up straight and become a good target for the enemy. Therefore, in the 1860's, weapons designers begin to work on the creation of a breech loading weapon. It should be noted that the first models of this sort of weapon, although they were far from perfected, were known as early as the 16th Century.

In Russia, breech loading rifles were generally remade from muzzle loaders. Three of these, the Green, Zhelle-trumer and Terry-Norman --had a separate loading system: the charge and bullet were placed into the barrel through the breech, but the cap was placed on a brandt tube and was burst by a blow from the striking hammer. In these rifles, tight closure of the barrel was not attained. The firing rate was only 5 accurate shots per minute. It could not be increased, since after each shot the firer had to place the cap on the rod. The firing pin type rifles available abroad at that time were able to fire 7-8 accurate shots per minute.

In 1867, it was decided to remake the 6 line rifle according to the system of the Austrian weapon maker Karle (see Figure). The new breech loading rifle was loaded with a single cartridge, containing powder, bullet and cap. The cap was fired by a special pin which was located in the bolt. 213,000 rifles were remade. However, the tests performed in the field revealed serious shortcomings: the paper shell case, which did not burn completely, flew out together with the bullet and hindered its flight; the pin often was broken or burned up.

The shortcomings of the Karle system rifle forced Russian weapons makers to use metallic cartridges. The primary advantage of a metallic cartridge case is that it is expanded under the influence of the powder gases when the rifle is fired and is thus forced tightly against the walls of the chamber, preventing breakthrough of the combusion product gases.

In 1868, a Navy Officer -- a Lieutenant BARANOV -- suggested a new cartridge with a metallic shell case and an original design for the bolt, which pivoted upward. Tests yielded favorable results, and it was decided to remake 10,000 rifles according to this system. At almost the same time, the Viennese weapon maker Krnk suggested another system for the 6 line rifle, whose bolt broke away to the side. Comparative tests showed that Krnk's rifle was cheaper to manufacture. It was quickly accepted as the standard weapon of the Russian Army, and the BARANOV system weapons were transferred to the Navy. BARANOV's cartridges were used in both weapons. This cartridge consisted of a lead cylindrical bullet, powder and a brass cartridge case, into the bottom of which the cap was pressed from without.

The relatively high weight of the metal cartridges forced another reduction in the calibre of the weapon. This made it possible to reduce the weight of the weapon, improve its ballistic properties, increase its accuracy, penetrating power and muzzle velocity.

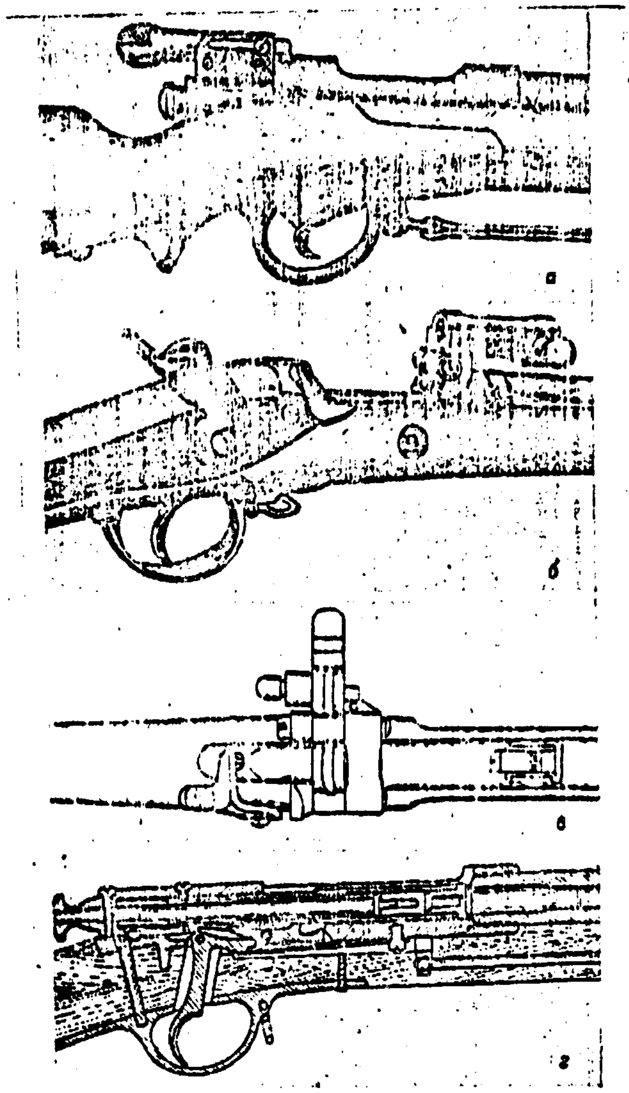
A 4.2 line calibre rifle was created in Russia. It was developed by General GORLOV and Captain GUNIUS on the basis of the 4.5 line rifle made by the American Berdan. Working on the Berdan model, the Russian designers changed the calibre of the rifle and created a new bolt, which pivoted upwards. In a word, they made the changes in design which have caused this system to be called the GORLOV and GUNIUS System. In America, it is known as the "Russian rifle."

30,000 such rifles were ordered. Berdan, who was in Russia at that time, suggested a new variant -- with a sliding bolt, which increased its rate of fire to 8-9 shots per minute. This model, called the "Berdan II" was used to equip the Russian Army in 1870. The cartridge for the rifle was developed by GORLOV and GUNIUS. At the same time, the 3 edged bayonet was replaced by a 4 edged model.

The "Berdan II" rifle, thanks to its high battle qualities, served the Russian Army for 21 years and was replaced only in 1891 with the magazine type "Russian 3 line infantry rifle", 1891 model, using the Mosin system.

During this 20 year period, numerous attempts were made to change the rifle system. Magazine loaded weapons became wide spread. Attempts were made to invent multishot rifles as early as the 16th Century. However, the earlier systems were insufficiently reliable, too complex and too expensive. Breech loaded rifles made it possible to resume work on the creation of a reliable, rapidly operating rifle. Single shot rifles begin to be transformed into magazine loaded rifles. The first magazines, which were tubes beneath the barrel, begin to be replaced by centrally located magazines charged with packs or clips.

In 1883, Russian designers begin working on a magazine fed weapon. A specially created commission included the chief of the shops at the Tula Small Arms Plant, Captain Sergey Ivanovich MOSIN. At first, the commission suggested that the work be limited to remaking the "Berdan II" weapon to a magazine fed rifle. However, the appearance of smokeless powder required the creation of a new rifle. In 1887, S. I. MOSIN received permission to design it. After 2 years, he presented his work to the commission. After long and complex testing, MOSIN's rifle and the rifle of the Belgian weapon maker Nagan were stated to be equal in quality. The MOSIN rifle was found to be cheaper and more comfortable, and was given preference.



Various types of rifled weapons: top, Karle; second from top, BARANOV; third, Krnk (top view); bottom, "Berdan II"

The MOSIN rifle was so successful that the Russian Army, in contrast to the armies of most other states, was not required to rearm itself in the latter part of the 19th and the beginning of the 20th Century. In 1908, a needle-pointed bullet was developed for this rifle, which considerably improved its ballistic qualities. Only in 1930, after 40 years of service, were some changes made in the rifle. These changes did not concern the basic design, but rather certain parts and attachments. In particular, in place of the infantry model, the dragoon model (with a somewhat shortened barrel) was used; the Kabakov and Kamarnitskiy bayonet catch was introduced, which improved the secure mounting of bayonet to barrel; the target sighting device was improved and protected from dirt; more convenient spring rings were introduced; the ramrod mounting, barrel guard, clip, etc. were improved. All these improvements made the MOSIN rifle the equivalent of the best foreign models. It served the army over 60 years -- an uncommon service life for a modern weapon.

Tekhinika i Vooruzheniye, No 8, 1966, pp. 36-40

TRAINERS IN THE TRAINING PROCESS

by

Colonel B. MOKHRAKOV and Reserve Colonel N. BASKAKOV

High quality battle training of troops is impossible without high quality training materials, in particular without the various trainers which allow habits of working with military equipment, weapons and apparatus to be developed and enforced.

Since we attribute great importance to this matter and want to give our aid to the military experts, the editors of this journal continue to publish articles and notes concerning new training aids which have been developed.

* * *

In order to perform parachute jumps from modern high speed airplanes, paratroopers must have good ground training. It is especially important to teach them to control their body in the air during free fall. A training aid which we have created allows the troops to develop these habits on the ground (Figure 1). It is a prefabricated metal design. The base I holds up the external 2 and internal 3 rotating frames. The side braces, made of T-beams, are set in concrete to a depth of 800 millimeters. They protrude 1600 millimeters above the ground. One of the braces holds a bracket, which in turn holds electric motor 4 and reducing gear 5 (1:26).

Figure 1. Trainer for ground training of paratroops

The external rotating frame, 2800 X 1900 millimeters, is made of 15 millimeter diameter tubing. It is reinforced with 25 millimeter diameter tubing and corner braces of sheet iron. The rotating movement is transmitted to this frame from the electric motor through drive system 6.

The lower portion of the frame holds a metal circle 600 millimeters in diameter made of 5 millimeter sheet iron with apertures beneath stopper feelers which fix the position of the internal frame.

The internal rotating frame, 2650 X 1700 millimeters, is welded up of 25 millimeter tubes. Support system 9 is mounted to its central position and contains models of the main and reserve parachutes and of the guiding system. The bottom of the frame contains two positive locaters with springs, which operate when the extractor ring is pulled out. Braces for the paratroopers feet are welded to a tube.

The system which rotates the external frame includes the electric motor, reducing gear, pulley, v-belt and clutch.

The one kilowatt electric motor is firmly connected with the reducing drive and operates from a 380 v power supply at 1400 rpm. The output shaft of the reducing drive carries a pulley wheel with a notch for a v-belt. The clutch is mounted on the shaft of the outer frame. It consists of an immobile disk mounted on a shaft (covered with friction material), a freely rotating pulley wheel (its diameter being 3 times that of the reducing drive pulley wheel), a freely rotating disk (with friction material), a compressor spring and a clamping nut.

The system provides for rotation of the frame with a rate of 35-40 rpm in both directions. The rotation is transmitted from the outer frame to the inner frame with 2 shafts 7, both ends of which have conical gears.

The stopping system 8 consists of an immobile metal circle with apertures under the stopping fingers, 2 internal frame fixers with springs, rollers, the break arm line, the stopping arms and a plank.

When the extractor ring, which is connected with the stopping lever, is pulled, the fixer springs are freed. The stopping fingers of the internal frame brakes enter the apertures in the metal ring of the external frame, and the rotation of both frames is stopped. Both frames are stopped in the position in which the paratrooper was located when he pulled the extractor ring.

The control system includes a magnetic starter and a remote control panel. The control panel has 3 buttons: "forward", "backward", "stop".

Before beginning each exercise, the leader must check the operation of the training aid, the state of the support system mounted on the internal frame and the start and stop functions of the training aid. When he is sure that all is working correctly, he explains the goal of the training exercise to the trainees and tells them how the exercise is performed.

Each trainee should be assigned a definite task. For example, he might be told what position he should be in, and how many rotations he should make before opening the parachute.

This training aid is a great help in training paratroopers for making parachute jumps with delayed opening of the parachute and long falling stabilization. It can also be used for training sports parachutists.

* * *

Our training model allows our students to study the rules of the road, to become familiar with the basic elements of the highway situation, to develop attentiveness while driving a motor vehicle, to learn to give signals early and to work out the primary elements in driving a motor vehicle. In a word, the trainer makes it possible to teach the students the entire set of practical habits needed before they actually sit behind the wheel of a motor vehicle.

The training model (Figure 2) reproduces the streets and squares of a city, streets and railroads; road signs are set up and automatic traffic signals are installed at intersections. The trainer is controlled from a special control panel which contains a board with controlling instruments and switches, a steering wheel and pedals. The student can move the model of the motor vehicle in various directions, change its speed or stop it at any time.

The mechanism for moving the motor vehicle is placed on the bottom side of the base of the model (Figure 3). Arm I with electromagnet 2 is rotated by a reducing gear and a 12 volt electric motor. The rate of rotation is controlled by a rheostat connected with the gas pedal. In order to stop the vehicle, the clutch pedal is depressed and the current is disconnected from the line.

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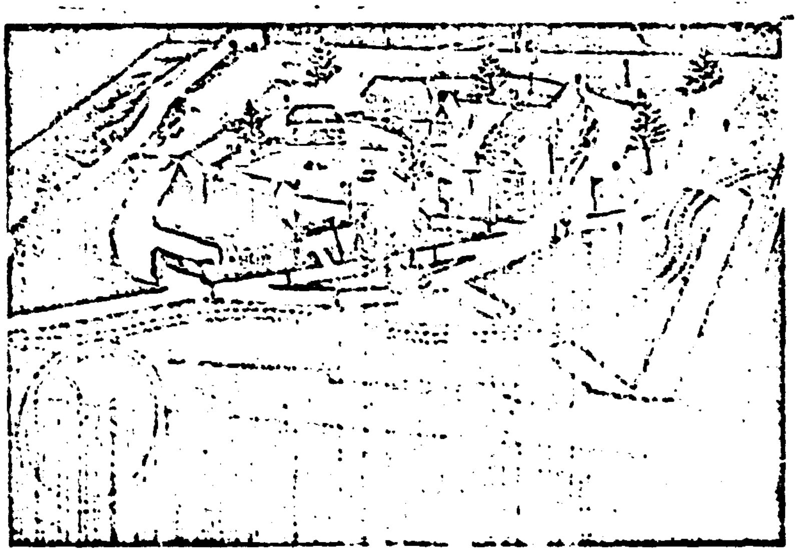

Figure 2. Training model for training military drivers

The electromagnet can move freely along the length of the arm. Ball bearing 4, acting as a feeler mechanism, is fixed to the electromagnet core and rolls along rail 3, causing the electromagnet to move. The feeler mechanism and the arm cause the electromagnet, and also the motor vehicle, to perform complex movements corresponding to the outline of the streets and roads on the model. The tracks have breaks in them which are covered by guide arrows 5. The arrows are moved by electromagnets connected to the turn signal switches located on the dash board, and they cause the vehicle to move in the direction desired.

The stop lights are automatically switched by a mechanism rotated by a special electric motor at 2 rpm. A transistorized electronic multivibrator can also be used for this purpose.

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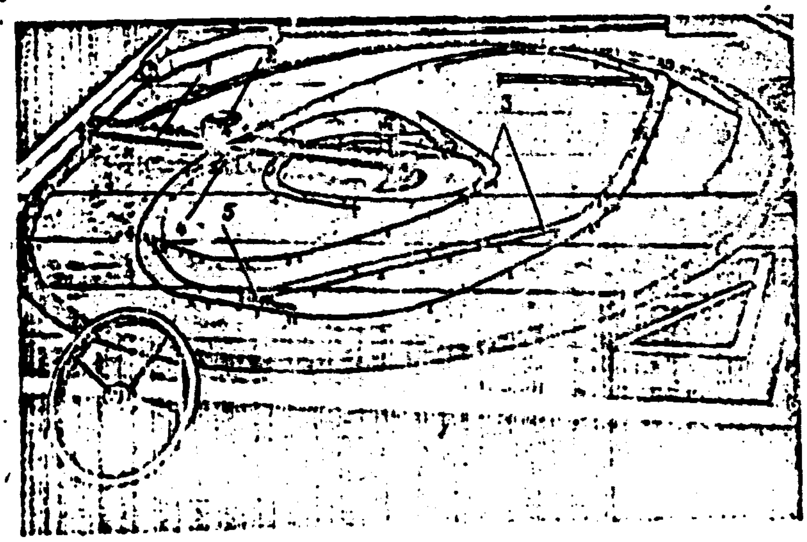

Figure 3. Moving mechanism

It is easy to work with the training model. It allows the students to reinforce their knowledge of traffic regulations.

Lieutenant Colonel D. KATS

* * *

The training stand for demonstration of methods to predict the radiation and chemical situation allows us to train officers in solving the most typical problems connected with radioactive and chemical contamination. It is used to determine the scale of radioactive contamination, to calculate possible dosages of radiation of personnel in the contaminated zone or passing through the contaminated zone, to find the resistance of the war gas in the area and the depth of permeation of the primary and secondary war gas cloud, as well as the time which gas masks must be worn.

The stand is mounted in a wooden frame 1 X 1.5 meters. The face side of this stand carries a topographical map which shows the tactical situation. The map is glued to a sheet of cardboard which has apertures representing locations where nuclear and chemical weapons have been used, zones of radioactive contamination, depth of movement of the air charge with the war gas.

The lower portion of the front panel of the stand has two pressure plates of organic glass, a light display panel, switches, 4 toggle switches, and a button labeled "answer".

The pressure plates hold down blanks containing the initial data and a description of the procedure for solving the problem. The student uses 3 switches to indicate the result to 3 digits: hundreds on the first switch, tens on the second and units on the third. The 4 toggle switches are used to turn on the lamps in the various sectors of the map. The switches located on the left hand portion of the display are used by the training leader to set up the answers to the problem.

A schematic diagram of the training stand is represented on Figure 4. Lamps L_1-L_4 are located in four sectors of the reflector. Toggle switches S_1-S_4 are used to turn on the illumination beneath the map, switches S_{1a}-S_{1c} indicate the numbers of the problems being solved, and the 9-position switches S_2-S_{13} (only 4 positions are shown in the diagram) are used to state answers to the problems. Switches S_{14}-S_{16} are used by the student to enter his answers to the problem. Relay R, of type MKU-48, the light display panel and button B are used to check the correctness of the solution of the problem provided by the student.

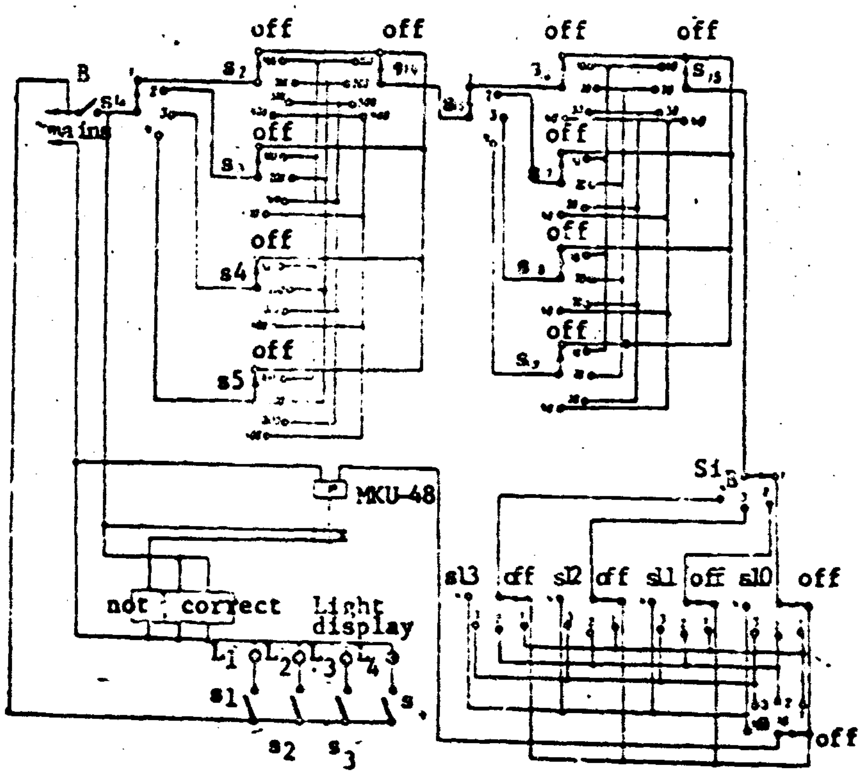

Figure 4. Schematic diagram of training stand

If switches S_{1A}-S_{1B} are in the first position, the circuit is considered ready for solution of the first problem. Placing switches S_2, S_4 and S_{10}, for example, in positions 100, 20 and 3 the leader can encode the answer to the first problem -- 123. In a similar manner, using the remaining switches, the answers to the second, third and forth problems are selected.

Solving the problem, a student gives his answer with switches S_{14}-S_{16}. If he solves the problem correctly, for example if he gives the number 123, the electromagnetic relay circuit R is closed.

By pressing button B, the student connects the relay, disconnecting the light under the sector of the light display containing the word 'not' The word "correct" appears on the display.

If, after trying several times, the student is not able to produce the word "correct" on the display, he should compare his solution with the solution presented on the blank.

The simplicity of the design of the stand and the possibility for changing variants of problems makes it expedient for usage in every chast' and military school.

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T AND V ANSWERS

The editors have received a letter. It was written to us by Engineer Lieutenant Colonel I. GERASIMOV, and it asks us to comment on the action of a judge in a tank driving test. In particular, Lieutenant Colonel GERASIMOV questions the fact that the judge did not follow the normal instructions for tank driving speeds which were established by the Commander of the Soyedineniye in consideration of the specific features of the tank driving range. Since he did not explain the driving speed before the test, this also resulted in some confusion. Finally, the writer of the letter wanted to know if it is necessary to maintain constant steepness over natural hills and descents and identical depth in water obstacles (norms for the course) throughout the entire length of these obstacles.

Apparently, these questions are bothering other readers. We decided to publish an explanation from the main administration for combat training. This is what we were told by General Major S. KONDRATENKO.

The commander of Soyedineniye or Chast' has the right to reduce the average speed of driving up to 15% from the established speeds. However, this must be done for each exercise individually and may change during the process of training. Suppose that exercises are begun in good weather, but after a certain period of time a strong rain storm begins, and driving conditions become considerably worse. This should indicate that it is not always wise to follow previous orders of the commanders of Chast' and Soyedineniye. All students, including driver-mechanics of any length of service and officers, must know the speed to be maintained before performing an exercise, in order to determine in advance what sector or crossing should most expediently be used. If over 30% of the students receive unsatisfactory marks in an exercise due to reducing the driving speed due to difficult driving conditions, the exercise leader (on the order of the commander of the Chast' or Soyedineniye) or the testing judge has the right to reduce the average driving speed, but not over 15%. After this, the marks are changed but the students may not drive through the course again.

For the 7th and 8th exercises, natural hills and valleys of various lengths and steepnesses are primarily used in the march route. If they contain a sector with the established minimal length and steepness, measured tangentially at 2 points, then no additional work need be done. We have in mind here reduction of the length or correction to identical steepness over the entire length of the ascent or descent. It is necessary that the steepness at individual sectors differ slightly from the established steepness. When there are more ascents than called for by the course, which hinders movement, average speed should be reduced by no more than 15%.

Identical river depth throughout the entire length of a ford is not necessary. It is necessary that the length of this sector be no less than the length of the tanks involved. In making an artificial ford, the steepness of the entrance and exits should be 15°, the depth over the entire length can be 15-25 centimeters less than the depth of the technical characteristics.

The dimensions of a tread way bridge (high level viaduct) should correspond to the dimensions of the tank bridge layer. In order to prevent capsizing of the tank, the side guard wheels are set on the high level viaduct 15-20 centimeters below the base wheels.

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TO LEARN, NOT JUST "STUDY UP"

Captain Second Rank V. YERMOLENKO

The officers of our Chast' discussed the article of General Major G. MIKHAYLOVSKIY* with great interest. This is understandable, since this article stated many important problems of the organization and methodology of technical training of Army and Navy Officers.

The article states in particular that officers, regardless of their specialities, should systematically supplement and perfect their technical knowledge, primarily on commanders' training exercises under the leadership of their immediate superiors. This, of course, is true. But if in the past year, as the author notes, the level of technical training for some officers continued to be low, the reason is apparently not that the senior officers permitted oversimplifications, formalism and superficiality in their training, although this does occur.

It is, of course, necessary to continue to strive for improved organization of exercises in the commanders' training system. But, in my opinion, it is impossible to radically solve the problem of rapid training with the new complex equipment in this way.

First of all, since only a limited portion of the overall time available for commanders' training can be used for technical training, this time is sufficient only for mastery of uncomplicated equipment (incidentally, some of the participants in the discussion of the article stated this quite definitely). It should also be considered that in the Chast' and Soyedineniye, class rooms and officers are equipped with simple equipment. They use, as a rule, mechanisms and weapons which have been fully amortized and which are, consequently, not the latest.

Secondly, this is impossible because battle equipment, which has for the most part passed through many stages of perfection (from mechanism to system of mechanisms, from system to complex), has now become so complex that not only considerable class time but also a highly qualified and narrowly specialized teaching staff are required for proper study of this equipment.

It is obvious that the senior officer is not able to independently process a large volume of technical information, prepare it in all aspects and instruct proper classes with his subordinate officers on the new equipment now being put in use. It is not surprising that many exercises in the commanders' training system consist only of familiarization with new equipment and study of its tactical and technical capabilities.

It seems to us that in order to improve the technical knowledge of the officers staff of the Army, Air Force and Navy, and to maintain it at its proper level, classes should best be held at teaching centers. Here, in the course of 2 or 3 months of study, the general technical knowledge of the officers would be raised and their technical outlook would be improved (we are speaking here of the minimum required for mastery of new equipment). The officers would study the new and latest equipment, new approaches and methods of its usage in battle and tactical problems in the

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volume necessary for fulfillment of their duties, according to the positions which they hold.

With sufficiently narrow specialization of the training, successful mastery of all that is new technically and all the changes in tactics associated with new developments can be attained in a short period of time.

The Navy, and apparently the other armed forces as well, have educational institutions where the knowledge of officers is perfected. However, they cannot provide for the main thing, which is constant improvement of knowledge. While studying in them, officers are separated for long periods of time from the performance of their duties. An officer arrives to study in many cases after 5 to 6 years since completing his formal schooling. Therefore, for mastery of new equipment we are forced to organize brief courses (assemblies) at plants and scientific centers. This study interrupts the production plan of the enterprise involved and is little affective, since the classes are held under conditions unsuitable for study.

Experience has shown that studying of new equipment is most successful in complete class room laboratories. Only the teaching centers allow us to make up these complete laboratories such as the "rocket ship" or "submarine", where the interconnection and interaction of all mechanisms is obvious and where any variants of the military usage of equipment and armament can be reproduced.

It would be good to make study in such teaching centers a requirement for all officers, regardless of their age, position or personal desire, no less often than 3 or 4 times per year. This sort of training is necessary for the senior officers most of all, since with an increase in position the circle of their duties increases, as does the period since they completed their formal education. Paradoxically, their subordinates, who recently completed their higher educational institutions, are often technically better informed than the superior officers.

In order that a course be brief and effective, it should have a concrete goal. But it often occurs that the officer is first taught the "general" aspects, i.e. his knowledge is first expanded and deepened in many directions, with no concrete duty in mind, then he is assigned to a duty. In his unit it is discovered that although he learned many useful new things, he is still insufficiently trained for his own particular duty, since the models of equipment used in his new Podrazdeleniye are not deeply familiar to him. The outcome is that after a long period of study he still must "study up a little."

Wouldn't it be better to assign (or note) a concrete duty to an officer at first, then train him at the teaching center over a brief period of time? Arriving at his Podrazdeleniye after this sort of training, a newly assigned commander or specialist would be familiar with his equipment; he would begin his service activity with assuredness in his new unit and would step forth bravely "right from the start."

"...We must learn the specific features of modern general war, which is fought by the combined forces of various branches of the armed forces, which requires their close cooperation," writes General Major G. MIKHAYLOVSKIY, and we agree with him completely. "Therefore every officer should know the capabilities and the principles of military application of weapons and equipment of the interacting forces." This is a very important note. All officers should turn their attention to studying the armament and technology of the interacting forces, especially the rocket troops, the Air Force and the equipment for observation and communications. Without the knowledge of the combat capacities of the interacting Chast' and their organizations, the tactical thought of the officer will not grow, and he will not be able to develop intelligent operative and tactical plans which answer the requirements of modern battle or to lead in tactical exercises.

Sometimes it occurs in our unit that during exercises we obtain exhaustive information about the "enemy", we know the composition of his forces and equipment, their location, their technical and tactical capacities. However, we must only guess about the forces of the Chast' interacting with us and their battle capacities, especially if they belong to another armed forces. Many difficulties arise in studying the armament and technology of other armed forces directly in the Chast' and Soyedineniye. It is considerably simpler and easier for the teaching centers to perform this function. As concerns commanders' training under the leadership of immediate superiors, it can more expediently be used for studying operative and technical documents, their usage and detailed checking of that which the officer should know and be able to do.

Tekhnika i Vooruzheniye, No 8, 1966, p. 43

WHAT TO STUDY?

Engineer Captain V. YAROSHENKO

The problems raised in the article of General Major G. MIKHAYLOVSKIY are familiar and well understood to the officers of the antiaircraft rocket troops. The requirements as to technical training placed on these officers, sergeants and soldiers have increased immeasurably. Experience has shown that an error of just one number in a calculation in tuning of an apparatus often leads to a sharp decline in the fire power of a weapon or even to missing an airborne target.

It is known that most technical problems which arise in guidance radar stations, in search and tracking stations, can be repaired in a few minutes. But their discovery, especially if the service personnel are not highly qualified, requires several hours. It is obvious that the quality and time required for tuning apparatus depends on the technical knowledge of the officers responsible for preparing the materiel portion of the command's responsibility for combat, and on their personal habits.

General Major G. MIKHAYLOVSKIY set forth a very important thought concerning the relationship between general technical and special disciplines, general and practical problems concerning the usage and combat application of equipment.

Let us take the following example. The probable enemy must be studied, of course, but the problem of what any given officer should know concerning him in particular is solved, in my opinion, often incorrectly. It is often stated that a junior officer (technician, platoon commander) is familiar with him on the "global scale" (total number of rockets, airplanes, Soyedineniye etc.), but does not know -- and this is very important -- the concrete capabilities of his equipment as concerns the creation of radio interference for the given type of antiaircraft rocket weaponry.

In many cases, an unjustifiable amount of time, planned for commanders' training, is spent in studying aerodynamics, a subject which is very useful but hardly practically important for communications officers.

Sometimes a station technician and a commander of a Podrazdeleniye need to have the same depth of knowledge of the operation of a certain circuit, and require identically good habits and familiarity in the tuning of apparatus. Obviously, for many commanders who do not have engineering training this task is simply impossible. The commander must be primarily concerned with the teaching and education of his subordinates and the attainment of coordinated action of his personnel, not with studying details of the design and the caprices of individual elements of equipment which he does not need to know.

A narrower direction is characteristic for the training of a technician. He must deeply understand the instructions for usage, the functional and schematic diagrams and also the characteristics of their primary elements. The commanders should clearly understand the functional connections between systems and understand the influence of adjustment of the primary units on the result of his shooting as a whole.

Various categories of officers bring their own special requirements for technical training, which is the cause of the variety of forms of technical training. They are all enumerated in the article of General Major G. MIKHAYLOVSKIY, and there is no reason to repeat them.

In conclusion, I would like to say a few words about the training literature. The armed forces are in great need of popular books which would contain fewer mathematical formulas and would pay greater attention to the physical processes which take place in the various circuits of radio electronic and automatic devices. The bibliography list "Radar Technology" published by the Military Publishing House is of great aid to specialists of the armed forces but could be well supplemented. First of all, we need literature on radar methods of selection of moving targets, operational amplifiers and other problems. The methodological aids and products of the middle and higher military schools and academies, as a rule, do not reach the armed forces. It would be desirable to publish certain of these works dedicated to such areas as the physical sense of maintenance operations and send them into the military Chast'.

Tekhnika i Vooruzheniye, No 8, 1966, pp. 44-49

TECHNICAL OBSERVATION POST

Engineer Colonel Candidate of Military Sciences P. ORESHKIN

In the initial period of the Second World War, when there was still a lack of experience and of the required technical equipment. our armored troops took significant loses due to the lack of timely evacuation of damaged or broken down vehicles, due to untimely aid given to tanks which stopped for technical reasons. In both cases, the vehicles became good targets for the antitank weapons of the enemy. Then, the situation was sharply changed. As a result of properly applied technical aid and evacuation of damaged vehicles from under the fire of the enemy, irreversible loses were reduced almost in half.

In order to evacuate a damaged piece of equipment or provide aid when needed, it is necessary to continually keep up with the course of battle, to know the state of the equipment, and to be able to analyze the situation and foresee possible developments of events, to correctly, in accordance with the situation as it develops, distribute forces and equipment. All these problems are solved at the technical observation post PTN, whose role and significance have increased immeasurably in modern day battle.

The PTN is the prime and basic link in the system of technical support, and one of the basic organs of technical reconnaissance, which is organized by the technical supply officer when on the attack and when in defense. The chief of the PTN may be the technical supply officer of the battalion or company. In additional to the technical supply officer of the company, there may be reserve mechanic-drivers and other team members at the PTN. They are used both for replacements and to give technical aid, mainly in preparing damaged or broken down vehicles for evacuation.

In order to determine the degree of contamination of a damaged vehicle, the PTN must have chemical-radiological warfare specialists and dosimetric apparatus. The Podrazdeleniye may include sappers if they are operating in the region of mine fields. Since the technical supply officer can not solve such problems himself, he reports to the Chast' commander in order to have the chiefs of the various specialities attach the corresponding specialists as required.

Considering the tasks layed upon the PTN, it is very important to select a location for it from which the entire attack sector of the battalion can be observed. The defense of the personnel there is also of prime concern. Hills and the edges of groves are most suitable for technical observation points. Experience confirms that the PTN should be placed near the command observation point. This allows those at the PTN to always be aware of the task of the battalion and the situation, i.e. to timely decide where help is needed. It is then also possible to use the headquarters radio network to transmit information to the regimental technical supply officer.

During the attack, the PTN moves by jumps, from cover to cover. Its maximum separation from the attacking Podrazdeleniye is decided by the conditions of the terrain and observation. In open areas, the PTN may be one kilometer from the attacking Podrazdeleniye, whereas in broken terrain with poor visibility, it must be closer. On the basis of these requirements, the PTN is best placed and moved on an armored personnel carrier with high cross country travel ability, supplied with the required communications facilities, from which continuous accurate control is possible. Communications should be supplied with the command observation point of the battalion and with the vehicle crews with the technical support facilities and, of course, with the senior service chief. It is difficult to set up communications in this way, but it is possible with the proper organization and usage of radio installed in the armored carriers, prime movers and mobile shops. The initiative and resourcefulness of the personnel can be of great significance.

In the course of the Second World War, in many cases combat tanks were used as battalion PTN. They were called the technical supply officer's tanks. This is how the problem of observation and technical support on the field of battle was solved in the battalion where the commander was Hero of the Soviet Union Major N. KUL'BYAKIN, and the technical supply officer was Captain V. TROFIMOV. Experience showed that this made it possible to constantly observe the field of battle without disrupting the order of battle, and to provide timely technical aid to tanks which were out of order.

Of course, such measures were taken during the Second World War due to the unavailability of transport and evacuation equipment to the battalion technical supply officer. Under present day conditions, the availability of technical support equipment has considerably increased, although similar measures cannot be excluded in the contemporary situation. In some cases, armored carriers might be set aside for this purpose, in other cases -- tanks, usually tanks with damaged weapons or with incomplete crews.

Naturally, in organizing technical observation points, it is necessary not only to provide the material basis, but also to see that it is properly and effectively used. Let us therefore analyze the work performed in the TOP during a battalion attack against an enemy defending himself (see outline).

When a tank goes out of order, data on the reasons for its halt and the necessity of technical aid can be produced by several methods. Naturally, the crew of the tank itself first reports to the platoon or company commander, then, plugging into the battalion technical support radio network, may report to the PTN commander the location of the vehicle, its state and the technical aid required. This is why it is very important to extend the radio network of the technical support unit down to the crew level. Another channel of information is direct overhearing of reports from crews to platoon commanders or company commanders on their radio network.

But what should be done if radio communication with the crew of the damaged vehicle can not be established by either method? Then a technical reconnaissance patrol headed by a company technical supply officer is sent out on a prime mover or armored carrier. The patrol determines the reason the tank has been placed out of order and provides the technical aid required: if this cannot be done, it reports this back to the chief of the PTN. The deputy battalion commander decides, or reports to the regimental technical supply officer that it is necessary to perform repair or evacuation.

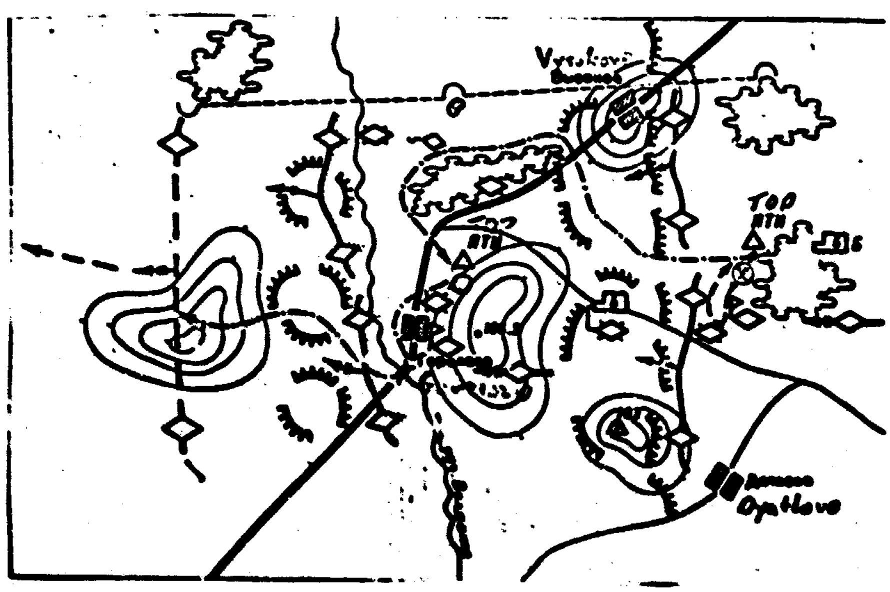
The PTN chief sends a prime mover and repair team to a machine which is out of order on the field of battle for rapid evacuation to the nearest cover. Of course, this decision may be taken as a result of direct observation of the field of battle, without clarifying the reason a machine has stopped.

Under some conditions it may be that the means available to the battalion technical supply officer are not sufficient to aid all the vehicles requiring aid at once. Under these conditions, those vehicles which can most rapidly be placed back in action are repaired or evacuated first. The other tanks are prepared for repair or evacuation.

During "primary" evacuation, the damaged equipment is sent to covered areas near roads so that the mobile repair equipment can approach for repairs. This is especially important when the Podrazdeleniye is operating over difficult broken terrain, or in winter under conditions of deep snow cover. The selection and evaluation of locations to which damaged machines should be evacuated is one of the tasks of the PTN chief.

In order to keep accurate track of vehicles needing technical aid, their locations and situations, the PTN commander keeps a battle damage journal. Experience shows that the most expedient form of such a journal is that presented below.

The accurate location of damaged or broken down machines is noted on a map as well, but it can not replace the account kept in the journal. It is impossible to reflect all the information required by superior commanders to decide on repair or evacuation on the map.



Since the decision to use repair and evacuation may be taken on the basis of reports, they should contain sufficiently complete data concerning the technical condition of the vehicles. If a vehicle cannot be repaired, it is important to indicate what parts or sections must be replaced and what special operations must be fulfilled. Therefore, the personnel of the PTN should be able to rapidly and accurately determine the volume of work required and the repair equipment which will be needed.

For more ope ve usage of the support equipment in some tank Soyedineniye during the Second World War the reports were sent not to the regiment but rather to the Soyedineniye technical supply officer. We note that this plan of transmission of reports concerning repair requirements and evacuation requirements is not very difficult to put into practice. The

Soyedineniye technical supply officer should also have a radio station and should be in permanent contact with the PTN.

JOURNAL

Account of battle damage in ______________________ on
Podrazdeleniye, Chast'

______________ 19____
Date

Number (in order)	Number of Vehicle	Type of Vehicle	Date and Time	Location	Reason for Damage	Nature of Damage	Measures taken

In battle, so called "irreparable" loses may also occur. Placing a damaged vehicle under this category should be done with great care. The battalion technical supply officer should personally be assured of this fact, not rely on the reports of "eye witnesses" or members of the crew.

In defense, the PTN performs the same tasks and work as in the attack. The order of evacuation of damaged vehicles is somewhat different. For example, not every tank which is damaged will be evacuated to cover or given over to repair by other methods. A tank which is damaged but which still has operating weaponry, as a rule, remains in battle order until the attack of the enemy is repulsed. It is evacuated to cover or to the repair location only upon the receipt of permission from the battalion commander. A vehicle with damaged weapons, regardless of the amount of technical aid required, is evacuated beyond the limits of the battalion defense region.

Proper organization of the operation of technical observation points is a very important problem, whose solution is important for timely restoration and return to action of damaged vehicles, and consequently to the battle capacity of the Podrazdeleniye. Therefore, organization and operation of technical observation points should be developed fully, with no simplifications or allowances for peace time during exercises.

Tekhnika i Vooruzheniye, No 8, 1966, pp. 46-47

FEEDER MAINTENANCE

The antenna-feeder system (AFS) of a radar station transmits the electromagnetic energy from the transmitter to the antenna, radiates it into space and also receives the reflected signals and transmits them to the input of the receiver. One of the most important elements of the AFS is the high frequency transmission line. It, depending on the radiated wave length, may be made of wave guides, rigid coaxial feeders or coaxial cables.

The quality of the operation of the transmission line is characterized by the standing wave ratio (KSV) and by the attenuation. In the practice of usage of this equipment, the KSV and the reflection coefficient connected with it are most often referred to. It is known that the less the SWC, the greater the electromagnetic energy transmitted from the transmitter to the antenna and the greater the range of the radar. If heterogeneities arise in the transmission lines, the SWC increases and the energy losses also increase. Increases in losses are usually caused by: poor matching of antenna with transmission line, dirt, water, scale caused by breaks in the wave guide (feeder), dents in the feeder walls or poor joining of wave guide elements.

Retaining the KSV within specified limits is one of the most important tasks of the personnel operating the radar stations. This is achieved by performing preventative maintenance on time and with high quality. The volume and sequence of preventative maintenance operations performed on the AFS are indicated in the corresponding divisions of the guides for services and directions. We would like to present our experience in performing some operations.

A characteristic problem with AFS, as we noted above, is high signal power loss in transmission lines or commutating devices. The reason for this may be improper assembly or mechanical damage to elements of the feeder, breaks in these elements due to moisture or leakage between feeder cores.

Checking of AFS should be begun with an external inspection in the direction from transmitter to antenna. First, the quality of the connections along the transmission line is checked with a magnetron. Overhead coaxial or wave guide feeders are checked by touch: at break locations, the feeder will be worn. Then, commutator dischargers are checked. Blackening of a discharge gap indicates that it is out of order. Problems most often arise in rotating wave guide azimuthal and elevation joints. In order to determine where the problem lies, it is necessary to rotate the antenna in azimuth and elevation while watching an instrument which indicates the magnetron flux. If the arrow of the instrument moves, it means one of the joints is either contaminated or out of order. In this case, the rotating joint should be dissembled and cleaned, and the bearings and bushings washed with alcohol, rubbed dry and lubricated with TSIATIM-201 lubricant. The lubricant should not be allowed to remain on the internal surface of the feeder. Otherwise, a deposit will be formed in this location which may lead to a breakthrough or the appearance of reflections (KSV increases).

It is recommended that AFS, including the rotating joints, be dismantled in a shop. When absolutely necessary, inspection or repair (dissembly) is permitted under field conditions during rain or snow fall. In order to keep moisture out of the feeder under such conditions, it is necessary to work under a tarpaulin.

After inspecting an AFS in its dissembled form, the internal surface of the feeders must be cleaned. This is done with a clean rag moistened with alcohol and wound around a wooden rod. Some feeder sections contain difficultly accessible locations. These sections should be covered on one end with a special plug, 50-100 cm^3 of alcohol should be poured in and agitated for 5-8 minutes. Usually the dirt (scale) will be dissolved in the alcohol in this period of time. In no case may a feeder be cleaned with emery paper.

Dents in sections of feeders are to be straightened out in the shop. Afterwards, a special stand must always be used to check the value of the KSV, Dents over 3 millimeters deep should not be straightened. Sections with these defects are better replaced with new sections. Fins and scratches on feeder flanges are removed and polished with GOI paste, applied with flannel. If the silver or passivated coating of wave guides is broken, these locations must be cleaned of oxides by GOI paste, dried with alcohol and covered with colorless lacquer.

After reassembly of the AFS, its tightness of sealing must be checked. The air pressure within the feeder is checked with a manometer. Air leak locations can be determined with soap suds. After making certain that the AFS is correctly reassembled, the high voltage is connected and the operation of the station is checked.

High quality coaxial cables, as are sometimes used as flexible feeders, are also carefully checked. During the external inspection it is assured that there is no mechanical damage to the outside surface of the feeder (cuts, fissures, crumbling, etc.), that the feeder plugs are tightly connected with the polyvinyl chloride covering of the cable, the pins and sockets of the plugs are in working order and make reliable contact.

The damaged polyvinyl chloride covering is sealed with polyvinyl chloride using a soldering iron. After this repair procedure, the damaged location is bound up with surgical tape, a bandage of threads is applied and covered with bakelite lacquer.

A new cable is usually tested for moisture resistance. For this, it is placed in a tub of pure water, with the ends of the feeder kept out of the water. After 2 hours, the cable is removed from the tub and the electrical resistance of the insulation is tested.

Tekhnika i Vooruzheniye, No 8, 1966, pp. 48-49

WE MAKE REPAIRS IN PLACE

By Senior Lieutenant A. BARANOV and Senior Lieutenant Yu. NIKITIN

The rapid repair of defective radio stations is one of the primary tasks before service personnel and repair organizations. Small Podrazdeleniye may not always be able to repair radio stations with their own resources. They are aided by roving repair teams made up of one to two men. In our unit, these teams usually consist of our most experienced radio technicians.

We know from experience what the most characteristic defects of various sections and parts of various apparatus are. This allows us to properly determine the quantity of spare parts and instruments required for repair. As a rule, the team takes the following along with it: various resistors -- 40, various condensers -- 20-30, selenium stacks 40 X 40 millimeters or diodes types D7Zh, D226 primarily 1500 v, diodes type D2Ye -- 10-15, a set of crystals for a type VD exciter, heat regulators, heat fuses and the KSR-4 measuring instrument set, allowing tuning of receivers and checking of antenna current of transmitters.

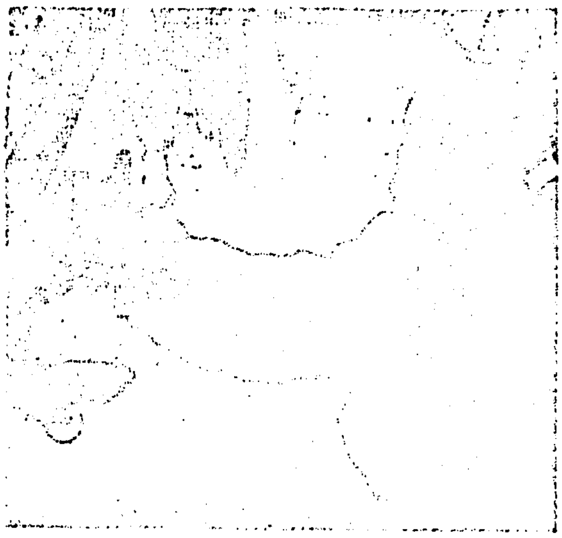
During repair, we use the oscillographs available at the radar stations. Using them to check each stage in sequence, we can easily find a defect in, for example, the exciters. If there is no high frequency vacuum tube volt meter, then, knowing the sensitivity of the oscillograph, we can easily measure the amplitude of the high frequency oscillations with the SI-1 synchroscope. Sometimes, in order to check for the presence of high frequency oscillations at high voltages, we use the type MN-3 MN-7 neon lamps or even a SG-3S or SG-4S voltage stabilizer. By holding the lamp near the high frequency stages of the transmitter, we can check for the presence of an HF signal by observing the shining of the lamp.

In some exciters, the joint between the crystal and the rod on which the quartz crystal is mounted may be melted due to overheating. In order to correct this defect, we open the screen. Using an accurately positioned soldering iron, we resolder the rods to the crystal at the location of the old joint, being careful not to overheat the crystal during this operation. Then the crystal is soldered to the mount and the case is resealed. These restored crystals, after they are checked in the exciter thermostat, usually work well.

In some models of UHF apparatus, the sensitivity of the receiver may be reduced, or the operation of the automatic channel selector or the type RKN relay may be disrupted. Therefore, when we go out into the field, we take a set of type KSR-2 measuring instruments, some functioning automatic channel selectors for the transmitter and a type RKN relay, a pulse motor with a spare contact group and spring (stopper) for the rachet, a receiver and transmitter lever mechanism type RSIU-3M. We use the KSR-2 to adjust the receivers and transmitters type RSIU-3M. During the adjustment, it is convenient to use a textolite screwdriver and a textolite probe with copper and magnetite tips. If the circuit begins to resonate when the magnetite-tipped probe is placed in it, the inductance should be increased. If the circuit begins to resonate when the copper tip is placed in it, the inductance should be reduced.

This method of repairing communications equipment by roving teams in the Podrazdeleniye requires the availability of light, small electronic measuring instruments. Unfortunately, we do not have such instruments. It would be desirable for these mobile teams to have a portable combined instrument containing a built in VOM and an oscillograph.

GRAPHIC NOT REPRODUCIBLE



Only 2 years ago, Communist Technician Lieutenant Yu. ShChATSKOV graduated from the Aviation School, but he is already an experienced specialist. In competition, Yuriy Mikhaylovich earned the right to have his airplane called outstanding. On the photograph: Technician Lieutenant Yu. ShChATSKOV inspects his airplane before flight.

Tekhnika i Vooruzheniye, No 8, 1966, pp. 50-55

WEAPONS AGAINST CORROSION

By Ya. Kolotyrkin, Corresponding Member of Academy of Sciences USSR, Director of Physics-Chemistry Institute Imeni L. Ya. Karpov

The five year plan for development of the national economy of the USSR during 1966-1970 calls for a sharp increase in the production of metals and alloys. Even now, however, every 8th blast furnace and open hearth furnace is occupied just in replacing losses of metal to corrosion. The losses which our country suffers each year due to corrosion are calculated in billions of rubles. These losses could be considerably reduced if we used contemporary, effective methods of anticorrosion defense. The weapons we can use are almost as varied as the corrosion processes themselves.

Fluctuations in the conditions of usage of products, which lead to changes in the rate and the character of their destruction, usually require replacement of one method of anticorrosion defense by another. We will comment only on the most important methods and on the most important results which have been attained.

Alloys, Alloyed Metals in Two Layers.

Metallurgists and corrosion specialists, working together, have been able to considerably increase the corrosion stability of metals by alloying various components and by heat treatment. Our industry is already making a large number of corrosion-stable metal materials of various types and grades. They include alloys based on iron, aluminum, magnesium, nickel, copper, etc. New alloys with chrome, iron, molybdenum and other metals have been made which are not subject to the action of especially corrosive media, some of them being corrosion free even in concentrated boiling nitric acid, which corrodes stainless steel.

Production has been begun of pure titanium and certain titanium alloys. Thus, the alloy of titanium with a small quality of palladium (approximately 0.5%) was first developed in our country. The addition of palladium facilitates the separation of hydrogen, which causes the potential of the corroding metal to be displaced toward the positive. This is sufficient to cause the alloy to be transformed to a passive state in solutions of nonoxidizing acids, so that it is not corroded in such solutions.

Methods have been introduced for additional alloying of ordinary steels with slight quantities of copper, chromium and phosphorus. This sort of alloying increases the corrosion stability of steel under atmospheric conditions by a factor of 5 to 8. Stainless chrome-nickel steels have been developed with reduced carbon content (0.03%), which have high stability against the worst enemy -- intercrystalline corrosion. It is hard to overestimate the significance and promise of the usage of these steels in the chemical, cellulose and food industries.

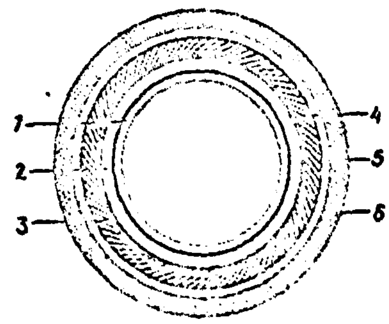
Additional alloying of stainless steels with molybdenum (3-5%) noticeably decreases their susceptibility to pitting corrosion.

Production has been begun of two-layered metals which are being widely used in the chemical industry and in related areas of technology. The primary layer of these metals is carbon steel, the plating layer being made of corrosion resistant chrome or chrome nickel steels, nickel and monel metal.

Metals and Nonmetals.

Metallic coverings are applied by various methods, including galvanic, chemical, gas flame and gas plasma methods. The most widespread method is the galvanic method. The scale of its application can be judged by the fact that 25, 15 and 50% of the world's production of tin, nickel and cadmium respectively are used for galvanic coating. The galvanic method is used to apply the most varied metals such as zinc, cadmium, tin, lead, copper, chromium, nickel, gold, platinum, iridium, rhodium and certain of their alloys.

Methods have been developed for application of multilayered coatings which have high adhesion to the base metal and good protective and decorative properties; methods have also been developed for applying single layered and multilayered shiny coatings which require no additional mechanical polishing. The wide usage of such methods in industry allows conservation of large quantities of electric power, of various scarce materials and chemicals required for the manufacture of polishing disks and pastes, plus large quantities of nonferrous metals which would be irretrievably lost in mechanical polishing. Preliminary calculations indicate that the total savings from the introduction of these methods might be as much as 200-250 million rubles per year. Also, the requirement for manual labor is reduced, which is especially important for the machine building industry. It has been calculated, for instance, that the application of coatings to motor vehicles takes up 10 to 12% of the total time expended on production of the vehicles, and that this figure increases to 15-18% for buses and 18-20% for bicycles.



Construction of a protective coating (band type) of a communications cable in an aluminum shell: 1, aluminum shell; 2, 5, polyvinyl chloride band, applied in bitumen layer; 3, 6, cable paper, saturated with bituminous composition; 4, steel armor.

Under certain conditions, metal coatings applied by chemical reduction of compounds of the corresponding metals have good protective properties. The most widespread process of this sort at the present time is the process of nickelizing [see *Tekhnika i Vooruzheniye*, 1966, No 6]. It differs from the galvanic method in that it is technologically simpler, more highly productive and produces an even layer thickness on parts of any configuration. Chemical nickelizing increases the reliability and durability of precision parts made of ferrous and nonferrous metals, restores worn parts, strengthens the surface and protects parts operating at high temperatures and under severe operating conditions; these coverings allow highly alloyed steels to be replaced by low alloyed and carbon steels.

In recent years, protective coatings have been ever more frequently applied to metals by the gas flame and gas plasma methods. For this, ordinary metals and alloys with melting temperatures up to 1500°C are used, as well as high melting metals, various ceramic materials such as carbides, borides and also high polymer resins and compositions made of them. World wide practice has shown that these coatings can be used to protect chemical equipment, water engineering constructions and especially important metallic constructions.

In cases when the metals are insufficiently stable, various non-metallic materials, primarily carbon-graphite, plastic and glass, are used.

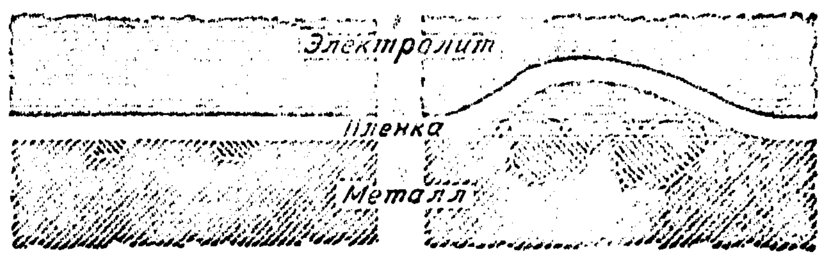
The basic carbon-graphite material used is graphite, saturated with various high polymer materials. Having exceptionally high resistance to extremely varied chemical reagents (with the exception of strong oxidizers), this material is characterized by high heat conductivity and strength. It is used to make apparatus which must operate under conditions of heat exchange and the action of corrosive media. In chemical machine building, carbon-graphite materials produced by pressing on a basis of a phenol-formaldehyde resin may also be used. Although these materials have a heat conductivity almost 4 times less than that of graphite, the heat conductivity is still rather high, approaching the conductivity of steel.

Lacquers, Paints and Synthetics

The application of lacquer and paint coatings is one of the primary and oldest methods of protecting construction parts, transportation and communication equipment and various types of machines. It is difficult to name a branch of industry or technology where this method has not been widely used. Briefly, over one half of the metal in use in the country is protected with paint and varnish coating. Paint and lacquer materials are often ineffectively expended, however, primarily due to improper technology and techniques in the application of the coatings. The pneumatic spray method, for example, results in very high losses of the material. Thus, in machine building, where approximately 80% of the paint and lacquer materials are expended, losses average 40%. These losses can be reduced. More perfected methods of painting such as spray drenching in solvent vapors, painting in an electric field, pneumatic or airless dusting, painting while heated, electrophoretic application of water based paints, etc., must be used. The advantages of these methods include both a considerable economy in paint and lacquer material and improved quality of the coating. The conditions of labor are also improved.

The effectiveness of paint and varnish coatings is considerably reduced if the surface to be painted is insufficiently prepared. Insufficient cleaning leads, as a rule, to a reduction in the adhesion of the coating with the metal, which always reduces the service life of the coating.

In recent years, a number of new synthetic coatings have been created which last for longer times and have better protective properties, not only under atmospheric conditions and under water at normal temperature but also in certain corrosive media at increased temperatures. The usage of such materials has a significant economic affect. It has been calculated, for example, that at the Kuybyshev hydroelectric power station alone, as a result of the replacement of Duznets basin lacquer with polyvinyl chloride lacquer and enamels, losses have been reduced by a factor of approximately six.



A paint or varnish film reliably protects metals from corrosion only if the surface is well prepared beneath the paint. If the film is separated the slightest bit from the metal (due to poor adhesion), trace elements go into action. As a result, a large amount of corrosion products is formed. These corrosion products, increasing in volume, may break the film. Key: 1, electrolyte; 2, film; 3, metal.

Inhibitors, Cathode and Anode Protection.

In the last 10 to 15 years, corrosion inhibitors have become one of the primary and most affective methods of prevention of corrosion damage to metal products in the electric power, chemical, petroleum production and petrochemical industries, as well as for conservation of equipment. Many dozens of various inhibitors are known, each of which is designed for certain specific conditions. The role of inhibitors (inorganic compounds such as phosphates, silicates, chromates and organic materials such as amines) is to interact with the metal surface and form thin protective films on it.

When metals are etched in metallurgy and machine building, inhibitors allow considerable reduction in the losses of metal (by 80-90%) and reduction in hydrogen absorption by steels, which is one of the reasons for cracking of complex structures.

In recent years, the so-called volatile inhibitors have been used to conserve metallic products and protect them from corrosion during long term storage and transportation. They are introduced either in the packing material or directly into the container. Practice has shown that the usage of volatile inhibitors makes it possible to increase the storage life of products to 5-10 years in place of 1-2 years, which was achieved by older methods.

The essence of the method of cathode protection is that, as a result of the application of a cathode current, the potential of the corroding metal is displaced toward the more negative values and, as is known, in correspondence with the laws of electrochemistry its rate of solution is decreased. The affect of this protection was first discovered in the course of purely theoretical investigations and only after several decades was it used in practice. Now, the method of cathode protection is used primarily to fight corrosion of ferrous metals in neutral media containing dissolved oxygen. The primary objects of this protection are underground pipelines, water engineering constructions, ships and some industrial equipment. Polarization of the metal of the structure being protected (displacement of its potential toward more negative values) is either performed by application of a cathode current or by connection of special protectors. The protectors, also called "sacrificial anodes", are made of alloys of more electronegative metals which, as they dissolve, give up their electrons to the metal being protected. It can be stated without exaggeration that the wide development of pipeline transport became possible only thanks to cathode protection.

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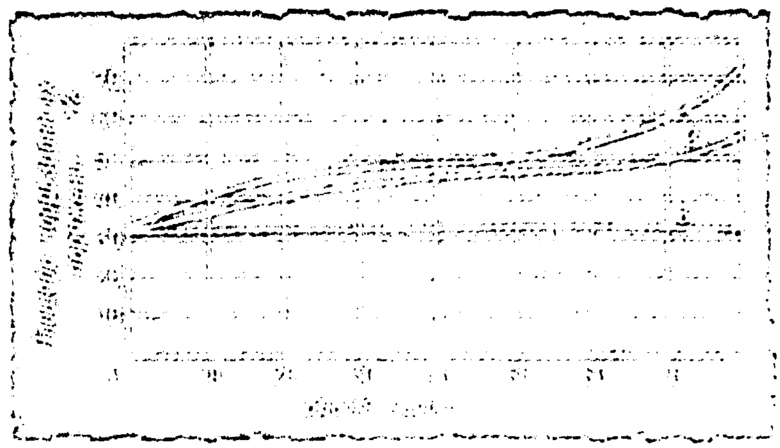


A corrosion process which has begun can be completely halted if the product is stored in a solution of sodium nitrite. It can be seen from the graph that the non-conserved product (curve 1) and the product conserved by type AK-10 oil (curve 2) continue to be intensively corroded. At the same time, the product conserved in a 30% aqueous solution of sodium nitrite (curve 3) shows complete halting of the corrosion process. Key: ordinate: area of corrosion damage, %; abscissa, time, days.

A new variant of the electrochemical method is the so-called anode protection, based on the property of many metals and alloys that they are able to transfer to the passive state when the potential is displaced toward positive values. This method can be successfully used to protect products made of various steels, titanium and its alloys and certain other materials in acid media. Anode protection is successfully used in the chemical and cellulose-paper industries.

Reduction of the corrosiveness of a corrosive medium is a no less effective method of combating metal corrosion. It is especially widely used in the power industry, including atomic electric power, where the basic problem is corrosion in water at high temperatures and pressures. The presence of traces of chlorides and dissolved oxygen in the water is the reason in this case not only for the increase in general corrosion but for an intensification of specific types of corrosive destruction — pitting corrosion and stress corrosion cracking. Ion exchange resins are used for purification of water from chlorides and oxygen; hydrazine, which reduces oxygen to water, and other materials are also used.

The proper selection of chemically or corrosion resistant material, just as the proper combination of various materials in the same structure or part, can be performed only by an engineer who is well acquainted with the principles of corrosion science and corrosion engineers who can properly perform preliminary corrosion testing and evaluate the results. Insufficient acquaintance with these principles or failure to heed them may lead to unfortunate results. In the newspaper *Pravda*, a case was reported when metal materials were used for the development of apparatus to be employed in a newly constructed artificial fibers plant without consideration of the corrosion resistance of these metal materials under the conditions to be met. The area led to catastrophic corrosion of the apparatus, considerably delayed the start-up of the plant and cost the state 400,000 rubles. Unfortunately, this example is far from unique. The proper selection of a construction material may be performed only on the basis of knowledge of its properties and costs, on the basis of consideration of the complexity and labor consumption of manufacturing products from it.

T and A Encyclopedia

Adhesion (adherence, cohesion) - formation of a thin layer of the tangent gas or liquid on the surface of a solid or liquid body.

Segregation -- heterogeneity of alloys in the solid state, arising as they crystallize.

Intercrystalline corrosion — corrosion which penetrates from the surface into the body of a metal along the boundaries of the crystallites (grains), explained by the presence of segregation heterogeneity, contamination and distortion of the crystalline lattice in these locations. This type of corrosion is observed in gaseous media and in electrolyte solutions.

Cladding — covering of surfaces of metal sheets with a thin layer of another metal by rolling a packet consisting of the metal to be clad and thin sheets of the other metal applied on one or both sides. Cladding is used in particular for application of thin anticorrosion layers of aluminum on sheets of duraluminum, used for airplane building and other purposes.

Tekhnika i Vooruzheniye, No 8, 1966, pp. 54-55

IN THE SEASIDE REGIONS

By Engineer Colonel, Candidate of Technical Sciences V. KALGANOV

In the northern seaside regions in winter, heavy snowfalls often occur. The average depth of the snow cover is 60-90 cm, the maximum wind velocity reaches up to 85 m/sec and the relative humidity reaches 90-100%. Obviously, these conditions create certain difficulties in usage of radar stations.

The corrosion of metals creates particular problems. Antennas, for example, when they are corroded, lose their mechanical strength and may be broken by high wind loads.

The strong winds carry large quantities of sand particles which, striking the antennas and radar station cabins, break up the protective paint coverings. In some regions, considerable quantities of water soluble salts, mainly chloride compounds of sodium and magnesium plus also sodium, potassium and magnesium sulfates, are carried along with the sand. When these salts enter the microfissures in the paint coverings together with moisture, hydrolysis of the salts takes place.

Aluminum antenna elements are extremely actively corroded. The corrosion extends rapidly to other elements as well. It is with good reason that this corrosion has been called the "aluminum plague." In order to prevent it from spreading, the damaged areas must be cleaned down to bare metal, then covered with primer and paint. It must be kept in mind that this "plague" can also develop underneath a protective paint layer. Therefore, when inspecting antenna devices, one must look carefully for protuberances and bulges in the paint.

Locations where different metals are joined are also subject to corrosion, and they should always be carefully observed during an external inspection of the radar station.

At times, parts are covered with only one layer of nitro dye. This naturally means that the protective properties of this layer rapidly disappear. The armed forces have developed and tested an emulsion (one weight part of drying oil dissolved in 6 to 8 parts of gasoline with the addition of 0.1-0.15 parts of a solvent). All the painted parts of a radar station are covered with this emulsion once each 2 to 3 months. The thin protective film formed by this treatment fills all the microfissures in the paint and does not allow the salts or moisture to penetrate into them. If the emulsion is systematically applied, the paint on radar station parts may last for 4 to 5 years, protecting the metal from corrosion.

Temperature changes also have a great influence on the corrosion of metals. During cold periods, the temperature of the air may vary from minus 30° to plus 2°C, during the summer - from plus 30° to minus 2°C. These temperature fluctuations lead to the appearance of frost or ice on wave guides, antennas and radar station reflectors. Within the cabin, the air temperature along the floor in winter is approximately minus 2°C, but may reach up to plus 50°C at the roof line. As a result, moisture condenses in the equipment rack cabinets, ice is formed on the floor, frost deposits in corners and the grease congeals in reduction drives. Under these conditions, corrosion of elements of the apparatus develops quickly, not to mention the fact that the resistance of cable and mounting wire insulation is decreased, the probability of a breakthrough in high voltage circuits increases and the resistance of contact groups is increased.

In order to avoid failures in the operation of apparatus, the apparatus must be carefully heated before turning on the high voltage, and after work is completed at the station, the rack ventilators must be turned on again 15 to 20 minutes after the equipment is turned off in order to ventilate the equipment.

During daily preventative maintenance, special attention is turned to drying the parts of the radar station apparatus and the water proof paste is carefully maintained. It is used to cover all cracks and gaps in the antenna column, doors, windows and hatches through which moisture might penetrate.

Tekhnika i Vooruzheniye, No 8, 1966, p. 55

WE ARE ANSWERED

In the article "Improving Supply", published in the journal *Tekhnika i Vooruzheniye*, No 3, 1966, Major N. SUKHOVITSKIY asks about the centralized supply of signals Podrazdeleniye with alkali-resistant varnish and rubber tubing for making valve and packing rings for batteries.

In answer to the letter of Major N. SUKHOVITSKIY, Signals General Major N. PROPIRNYY reports that the supply of signals Podrazdeleniye with chemically stable varnish and enamel, as well as with rubber tubing, is performed centrally through the administrations (departments) of the signals forces chiefs of the military districts and the corresponding supply organizations of the armed forces.

Also, for maintenance and repair of batteries, sets of spare parts are distributed which include spare plugs and rubber rings.

Signals Chast' should refer to the signals chief of the military district where the Chast' is located with all supply problems concerning operating supplies.

Tekhnika i Vooruzheniye, No 8, 1966, pp. 56-59

THEY ARE LOADING...

The directives of the XXIII Congress of the CPSU, in its five year plan for development of the economy of the USSR for 1966-1970 indicates the necessity of more complete usage of all types of transport equipment, for reduction of stoppages under load, increasing the through put and load carrying capacity of the railroads. It is therefore very important to attain efficient usage of the rolling stock, to more widely used condensed loading of equipment and to be able to load the heavy and large equipment which our industry will be producing in ever greater volumes in the new five year plan.

In the material published below, the reader will become acquainted with one of the variants of compressed loading of stakebed trucks (the inclined method) as well as the rules for loading motor vehicle trains for railroad transportation.

...Motor Vehicles

Before loading empty stakebed trucks by the inclined method onto railroad flat cars or onto chains of flat cars (not over 7), the steering and brake systems are checked, as are the tire pressures, which should be the same as for highway driving. The fuel tanks of the inclined vehicles are filled only one third full. The top bows, tarpaulin and side seats are removed, and the tail gates are opened.

The first vehicle is placed horizontally, and the rest are inclined (Figure 1), those with the widest bodies being placed in front. The loading is performed so that the front wheels of the inclined vehicles are above the cross bracing of the bed of the truck in front. In order to prevent damage during movement of the train, spaces are left between the vehicles: for the vehicles placed on the flat cars, no less than five centimeters; for vehicles above the couplings between flat cars -- no less than 22 centimeters.

Vehicles may be loaded under their own power or with a crane. If the vehicles are loaded under their own power, four ramps, 0.35-0.40 meters wide are made for each 15-20 vehicles. Two ramps, 2.65-3.00 meters long are used for loading the first inclined vehicle, and two others 1.5 meters long are used for loading the remaining vehicles.

Cranes (motor vehicle loaders) are most useful when the vehicles must be placed in railroad cars with high sides. Using the vehicle loaders, loading is performed only from special loading and unloading platforms. Each crane is aided by a team of four to 6 line handlers. The team is divided into two groups: one (near the rail line) attaches straps to the vehicles, the other places the vehicles in the cars and removes the straps. The strapping is done so that the fenders and hood are not crumbled, and the lights are not damaged. Metal or wooden braces are placed between the straps and the sides. Wooden strips are placed where the cable meets the floor or frame of the truck body.

If the available crane has a lifting capacity of less than five tons, a combined loading method is used. The vehicle is driven onto the platform under its own power, the crane raises the front axle and then the vehicle is driven forward 1.5-2.0 meters in order that the front axle is placed over the body of the vehicle in front.

Rolling Stock	UAZ-450 UAZ-451D	GAZ-51 GAZ-63	GAZ-53	ZIL-150 ZIL-164	ZIL-151	ZIL-130	MAZ-200
	Types and quantity of vehicles						
two axle flat bed cars:							
one	3	2	2	-	-	-	-
two*	-	5	5	4	3	4	3
four axle flat bed cars:							
one	5	3	3	-	2	-	2
two*	-	8	7	7	5	7	6
three*	-	13	11	11	8	11	10
four axle cars with sides:							
one	5	3	-	-	2	-	-
two*	-	7	-	7	5	-	-
three*	-	11	-	11	8	-	-

* chain

The motor vehicle placed horizontally is braced with four wire cables under tension and wooden beams are placed underneath the rear wheels on both sides and in front of the front wheels. With the first and the last inclined vehicles, wooden beams are placed on both sides beneath the rear wheels; the rear axle is held down with four cables. The vehicles over the flatcar coupling is held down with two cables under tension; wooden beams are placed before and behind the rear wheels. Wooden beams are also placed before and behind the rear wheels of the other vehicles. The rear axles of all the inclined vehicles in railroad cars with sides are held down with four cables under tension attached to the lugs or rings of the cars.

When ZIL-151 three axle trucks are loaded onto flatcars, wooden blocks 0.6-0.8 m long and 0.15-0.20 m high are placed under the wheels of the middle axle of the first inclined vehicle and nailed to the bed with 3-4 nails each.

If chains are being formed of railroad cars, in order to prevent their being broken up, the following is written in chalk on the sides of the railroad cars: "Do not uncouple chain". The handles of the uncoupling arms are tied to the supports with wire.

The norms for placing motor vehicles onto railroad cars are shown in the table above. It is important to note that the usage of inclined loading reduces the requirement for rolling stock and expenditures for transportation by 40-50% on the average.

Major A. FURMAN

...Truck trains

Before loading truck trains, it is necessary to make an especially careful check of the vehicles. Brake systems and steering systems are checked, normal pressure (as for highway driving) is put in the tires, all rotating and swinging parts are fastened down. With four axle armored carriers for example, the water repelling shields are set and fastened in the running position. and the towing attachments are set in the nonoperative position. If the armored carrier is used as a tractor in the loading process, the towing attachment is placed in the nonworking position after the armored carrier is placed onto the flatcar. In truck trains with single axle saddle tractors (MAZ-529V, Mo AZ-546, Vel AZ-531) the outer wheels of the semitrailer must be removed. Sometimes, even more complex work is performed; individual units are removed, the axles are removed, etc.

Four axle tractors (MAZ-535A, MAZ-537G, etc.) are placed one on each four axle flatcar; armored carriers are placed one on each four axle or two axle flatcar. These vehicles cannot be placed above the coupling of the flatcar. Two armored carriers can be placed on one four axled flatcar, but then they will extend beyond the end bars of the flatcar by over 400 mm. A flatcar thus loaded must be hooked at both ends to flatcars loaded with other equipment.

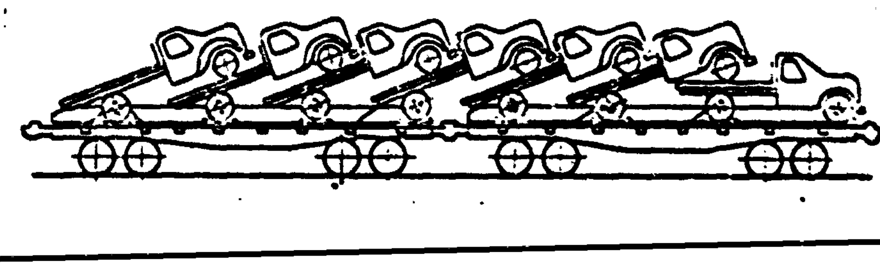
Truck trains not over 13.8 m long are placed on flatcars with wooden sides; truck trains not over 14.2 m long can be placed on flatcars with metal sides. Longer truck trains are placed on chains of two flatcars. A truck train for which the distance between the front axle of the tractor and the rear axle of the semitrailer is not over 11 meters can be placed with all its axles on one four axle flatcar, although the overhang of the semitrailer which exceeds 400 millimeters will extend over the next flatcar, which must be loaded with other equipment.

Most truck trains are loaded onto car chains, with the semitrailer or tractor over the coupling. When this is done, two sometimes forgotten situations are important. First, the wheels of the semitrailer or the front wheels of the tractor must roll freely on the flatcar. Second, the flatcar on which these wheels are placed should also carry some other equipment. The tractor and semitrailer may be loaded separately onto different flatcars. This is a more difficult method, since the semitrailer must be uncoupled from the tractor.

Four axled trucks and truck trains are loaded under their own power from end (or side) loading platforms or equipment. This is difficult even for an experienced driver. The problem is that the track width of these vehicles is very close to the width of the flatcar so that the wheels are driven onto the very edges of the flatcars: the slightest inaccuracy may cause a vehicle to turn over. In order to avoid this the trucks must be driven from the platform onto the flatcar, and from flatcar to flatcar strictly parellel to the long axis of the flatcar, at very low speed, smoothly, using only standard crossing rails. All driving wheels of the vehicle must be powered-- this makes the driving easier.

Loading from the side is even more difficult. A loading platform no less than 25 meters long is required. In order to be able to turn while driving onto the flatcar, one or two empty flatcars without braking areas plus a ZIL-157 with a winch or a tractor must be available beside the flatcar or coupled with the flatcar onto which the loading is taking place. They are used to line up the rear axle of the vehicle or the wheels of the semitrailer on the flatcar.

If the loading of an echelon is performed at night, it is useful to assign special observers to watch the movement of the wheels along the loading



platform, transfer bridges and flatcar bases. If the danger arises that a wheel may roll off, the observer signals the commander. In all cases, only the signals from the loading director are to be followed by the driver.

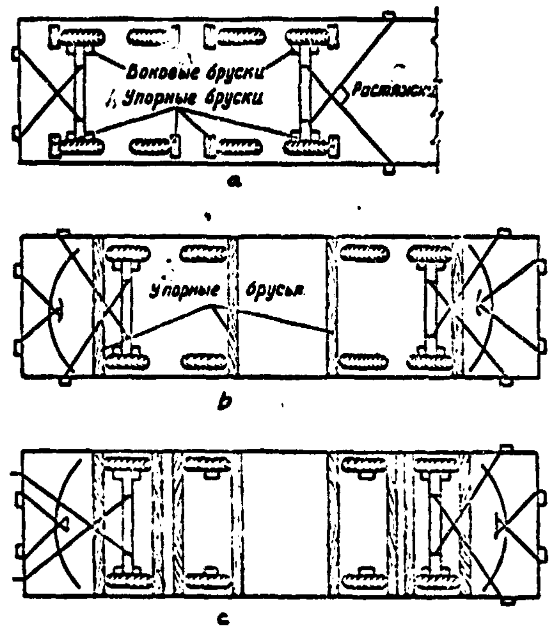


Figure 2. Fastening four axled trucks up to 12 tons (top), from 16 to 22 tons (middle) and from 22 to 24 tons (bottom) onto flatcars. Key: a, side braces; b, end braces; c, tension links.

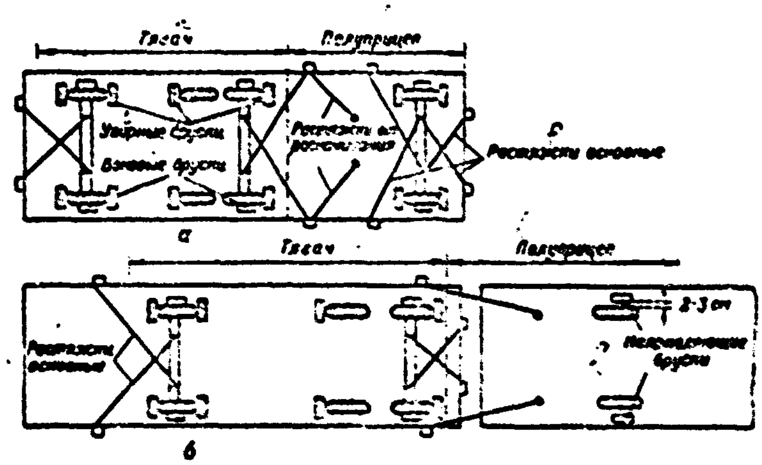


Figure 3. Fastening of truck trains weighing 12-16 tons (top) and 8-12 tons (bottom) to flatcars. Key: a, tractor; b, semitrailer: c, braces; d, side braces; e, extension members to prevent separation; f, main extension members; g, directing braces.

For safety, the equipment is firmly fastened to the flatcars (Figures 2 and 3). Four axle armored carriers are fastened down with braces 45 X 15 X 15 cm, heavier equipment -- with 275 X 15 X 15 cm braces. All vehicles are also retained by side braces 40 X 15 X 15 cm; truck trains are held down with 40 X 15 X 15 cm braces and 40 X 10 X 10 cm side or directing braces. In all cases, nails 175-200 mm long are used. Both four axled trucks and truck trains are held down in addition by 4 to 8 extension members made of cables or six millimeter diameter wire, 4-6 strands. In order to speed up loading, it is advisable to assign a soldier from the loading and unloading teams to help the vehicle crews. They should work under the leadership of the team (crew) commanders. After all the vehicles are fastened down, they are put in low gear and the hand brakes are set.

Lieutenant Colonel M. NETYKSA

GRAPHIC NOT REPRODUCIBLE

The airplane serviced by Communist Senior Technician Lieutenant A. BONDARENKO has taken off. Anatoliy has a free minute so, not losing time, he is studying the structure of a piece of equipment.

Tekhnika i Vooruzheniye, No 8, 1966, pp. 60-63

CROSSINGS AND HYDRAULICS

V. Savel'yev, Candidate of Technical Sciences;
A. Smolyak, Engineer

Until recently, some specialists thought that hydrodynamic factors had only an insignificant influence on the hydraulic stability of crossing-bridge structures. What was the basis of this opinion? It resulted largely from the fact that the constructions used earlier had smooth abutments of considerable length with considerable excess water displacement. It was thought that this excess displacement and abutment length were the determining factors in the stability of the river crossing.

Some modern pontoons have lesser abutment lengths and comparatively less excess displacement. Also, another feature of this new equipment is greater reduction of the cross section of the stream. These facts make it necessary to consider both the hydrostatic and hydrodynamic forces which arise as the pontoon moves or as the bridge is set at anchor. The distribution of these two types of forces and their magnitudes depend on the distinctive features of the water flow and the design of the pontoon, as well as the magnitude and distribution of load.

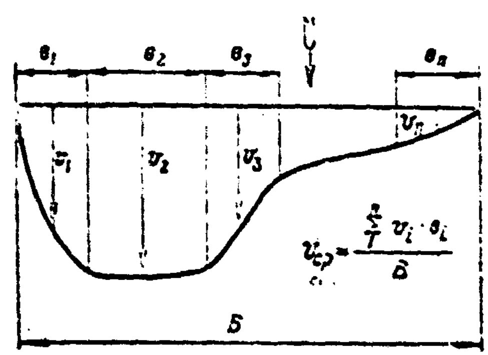


Figure 1. Distribution of flow velocities across cross section of river

The resistance of floating bridges and ferries to the water flow and their hydraulic stability are determined by the rate of flow of the river, its depth, the ratio of areas of the cross section of the flow and the cross section of the bridge abutments or ferry footing, and also the design features of the river crossing means and the location and weights of loads upon them. It is also important to know the distribution of flow rates across the section of the river. The most important parameters are those such as mean flow rate across the cross section, mean river depth and load supported by the floating crossing.

The mean depth is produced by dividing the cross sectional area by the width. In order to determine the mean velocity of flow, the water flow must be divided by the area of the cross section (in the following, in speaking of bridges, we will be concerned with mean velocity and depth).

In performing engineering reconnaissance of a river, usually the maximum flow rate of the surface layer of the water is determined, although the flow rate changes with depth of the river as well (Figure 1). Knowing the surface velocity, it is possible to approximately determine the mean velocity over the cross section:

$$V_{av} = \frac{V_s}{K},$$

where V_{av} is the average flow rate over the cross section of the river; V_s is the maximum surface flow rate; K is a coefficient varying between 1.1 and 2.2.

In the case when the movement of ferries is analyzed, the velocity of the ferry relative to the water is considered. If the ferry moves across still water (a lake), this will be its rate of movement relative to the bank. If the ferry is moving across a river, the geometric difference of the velocities of ferry and stream flow must be considered, not the average but rather the local stream flow being considered.

The resistance of floating bridges and ferries is proportional to the square of the mean flow rate. If a bow wave is formed (wave resistance), the total resistance rises considerably more rapidly, causing an increase in the horizontal and vertical forces against the anchor lines and the abutments. This must be considered when the bridge is fastened in place. The flow rate may increase after rain showers or during release of water from reservoirs.

As the flow rate increases, a floating bridge gradually begins to exhibit bow heaviness. The waves begin to splash over the bridge, the bow heaviness becomes even greater and the bow points submerge completely. If emergency measures are not taken the bridge may even sink. It is characteristic that the danger of sinking arises on rivers which are not deep. If the depth is very slight (comparable to the draft of the floats) then the bow heaviness appears at the same flow rate, the bow points submerge in the water, but then they rise again and tail heaviness may arise. The problem is that the water pressure is unevenly distributed along the length of the keel of the floats. The degree of irregularity depends on the flow rate relative to the pontoons. The higher the flow rate, the greater the decrease in pressure underneath the pontoons. The pressure decrease reaches a maximum underneath the bow points and the forepart of the flat bottom; over the remainder of the surface the pressure distribution is mainly even. At the same time, the pressure at the bridge deck remains unchanged, equal to atmospheric pressure. This pressure distribution leads to bow heaviness of pontoons (Figure 2a).

When this occurs, the cross section of the flow is reduced, which causes even greater increases in the flow rate around the pontoon, and therefore also an even greater decrease in pressure under the bow portion of the bottom of the pontoon. The pressure drop may be so great that the bridge sinks completely, bow first, that is it submerges. With very slight depths, the bow wave is increased much more intensively. The hydrodynamic pressure on the front part of the pontoon increases and the bow points are raised out of the water (Figure 2b). Flow restriction arises then in the rear portion, where the flow rate considerably increases and a pressure decrease under the stern takes place. This causes stern heaviness, which sharply (by dozens of times) increases the flow resistance, that is the structure supporting the bridge sinks which may cause such a high list that it becomes impossible to use the bridge. With great depths, the flow rates do not change sharply, so that the pressure drop beneath the bow of each pontoon does not reach dangerous values.

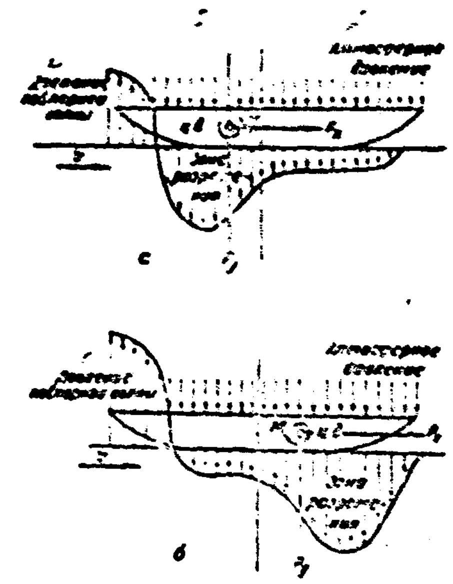


Figure 2. Graphs of distribution of pressure acting on pontoon; a, low pressure area displaced toward bow of float; b, low pressure area displaced toward stern; c, bow wave pressure; d, atmospheric pressure; e, decreased pressure zone; f, center of pressure

With the same flow rate, the resistance of all floating constructions increases with a reduction in river depth. This increase is especially notable at low relative depths (the relative depth is the ratio of the mean depth to the average draft of the ship). From the graph (Figure 3) we can see that if the relative depth is greater than ten, the resistance is retained practically constant. In this case, we speak of unlimited depth. When the relative depth is less than five, the resistance begins to increase sharply, which must be considered in the practice of producing a crossing in shallow water.

Both floating bridges and ferry boats lose their stability at low speed with a reduction in depth. The influence on bridges with separate abutments is more severe than on ribbon bridges (Figure 4). It is characteristic that splashover begins earlier on bridges with individual supports, but the total loss of stability occurs earlier on ribbon bridges. An increase in load weight or a reduction in distance between loads considerably changes the resistance of both bridges and ferry boats to the current. It can be considered with accuracy sufficient for practice that the resistance at the same flow rate and flow depth is proportional to the load being carried.

The position of the load relative to the axis of the bridge or ferry also influences the amount of resistance. If the water resistance of the bridge (ferry) when the load is located precisely on its central axis is taken as 100%, then if the load is transferred to the upper bulkhead the resistance is reduced to approximately 95% (bridge) or 98% (ferry). On the other hand, lowering of the load to the lower bulkhead increases the resistance to 115 and 120% respectively.

An increase in the load, as well as a reduction of distance between loads, considerably influences the stability of a bridge. The graph (Figure 5) shows that with a load of, let us say 60 tons, an increase in distance to double allows safe usage of a bridge in a location where the flow rate is considerably greater.

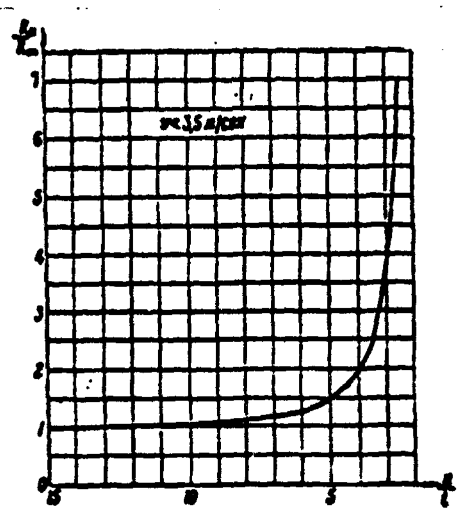


Figure 3. Influence of river depth on resistance of floating body; H, mean river depth; T, ship draft; R_H, resistance at given depth; R_{00}, resistance at unlimited depth.

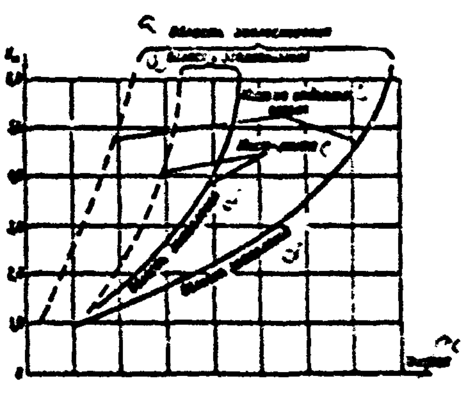


Figure 4. Zone of stability of floating bridge on individual supports and ribbon bridge. Key: a, splashover zone; b, bridge on individual support; c, ribbon bridge; d, sinking zone.

The stability of a bridge or ferry can be increased by using a special device. One such device is shown on Figure 6. It consists of shields placed at the bow and stern of a pontoon at a certain angle to the oncoming current. The bow shield creates an additional lift at the bow of the bridge or ferry. Also, they have the same effect as increasing the height of the freeboard at the bow portion of the float, as a result of which the hydraulic stability is increased by several times. These shields are most suitably placed at an angle dangerous values.

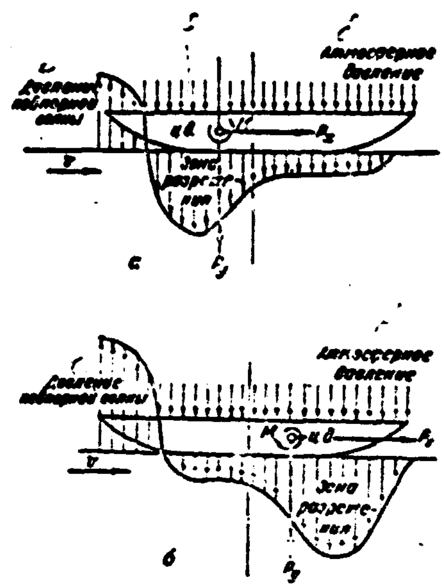


Figure 2. Graphs of distribution of pressure acting on pontoon; a, low pressure area displaced toward bow of float; b, low pressure area displaced toward stern; c, bow wave pressure; d, atmospheric pressure; e, decreased pressure zone; f, center of pressure

With the same flow rate, the resistance of all floating constructions increases with a reduction in river depth. This increase is especially notable at low relative depths (the relative depth is the ratio of the mean depth to the average draft of the ship). From the graph (Figure 3) we can see that if the relative depth is greater than ten, the resistance is retained practically constant. In this case, we speak of unlimited depth. When the relative depth is less than five, the resistance begins to increase sharply, which must be considered in the practice of producing a crossing in shallow water.

Both floating bridges and ferry boats lose their stability at low speed with a reduction in depth. The influence on bridges with separate abutments is more severe than on ribbon bridges (Figure 4). It is characteristic that splashover begins earlier on bridges with individual supports, but the total loss of stability occurs earlier on ribbon bridges. An increase in load weight or a reduction in distance between loads considerably changes the resistance of both bridges and ferry boats to the current. It can be considered with accuracy sufficient for practice that the resistance at the same flow rate and flow depth is proportional to the load being carried.

The position of the load relative to the axis of the bridge or ferry also influences the amount of resistance. If the water resistance of the bridge (ferry) when the load is located precisely on its central axis is taken as 100%, then if the load is transferred to the upper bulkhead the resistance is reduced to approximately 95% (bridge) or 98% (ferry). On the other hand, lowering of the load to the lower bulkhead increases the resistance to 115 and 120% respectively.

An increase in the load, as well as a reduction of distance between loads, considerably influences the stability of a bridge. The graph (Figure 5) shows that with a load of, let us say 60 tons, an increase in distance to double allows safe usage of a bridge in a location where the flow rate is considerably greater.

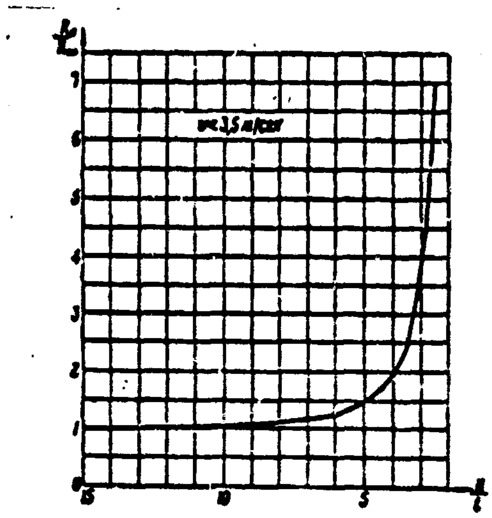


Figure 3. Influence of river depth on resistance of floating body: H, mean river depth; T, ship draft; R_H, resistance at given depth; R_{00}, resistance at unlimited depth.

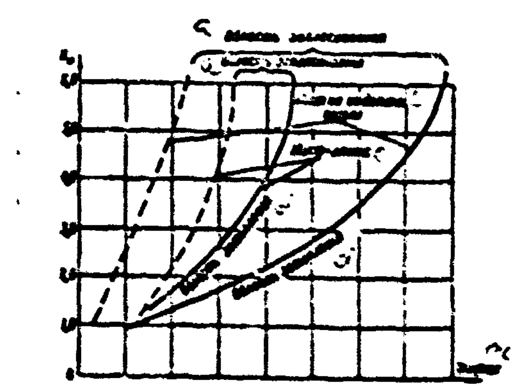


Figure 4. Zone of stability of floating bridge on individual supports and ribbon bridge. Key: a, splashover zone; b, bridge on individual support; c, ribbon bridge; d, sinking zone.

The stability of a bridge or ferry can be increased by using a special device. One such device is shown on Figure 6. It consists of shields placed at the bow and stern of a pontoon at a certain angle to the oncoming current. The bow shield creates an additional lift at the bow of the bridge or ferry. Also, they have the same affect as increasing the height of the freeboard at the bow portion of the float, as a result of which the hydraulic stability is increased by several times. These shields are most suitably placed at an angle of 45° to the horizon. The distance from the bow to the shield is selected depending on the size of the shield and the flow rate. The resistance of a bridge (ferry) equipped with shields is increased by 10-30%. The anchor and mooring devices of these crossings must be reinforced. The stern shields, placed at an angle of 5-10° to the current, reduce stern heaviness resulting from slight river depth. They have very little influence on the total resistance, but should be used only in combination with bow shields. Combined installation of stern and bow shields increases the stability and allows a reduction in listing to a value which is suitable for usage.

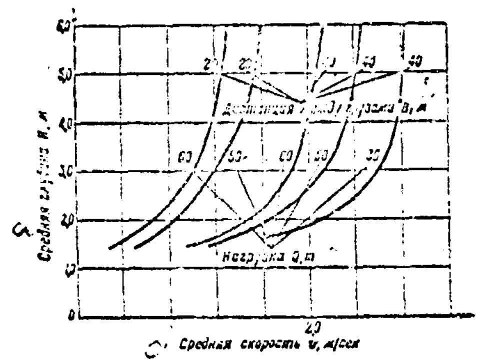


Figure 5. Influence of load and distance between loads on stability of floating bridge. Key: a, average depth H, m; b, distance between loads B, m; c, loads Q, t; d, mean flow rate v, m/sec.

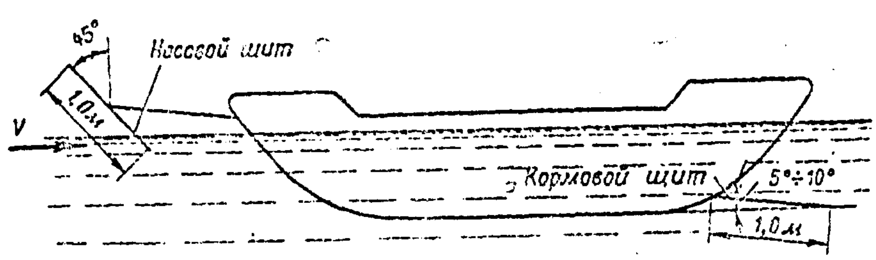


Figure 6. Device for increasing stability of pontoon (link). Key: a, bow shield; b, stern shield.

Thus, in order to properly select the method for installing and mooring a bridge, to determine the required number of floats and to take timely measures to provide stability of the construction during flooding, certain questions in hydraulics of floating bridges and ferries must be answered.

Tekhnika i Vooruzheniye, No 8, 1966, p. 63

TECHNICIAN OF AN OUTSTANDING AIRPLANE

By Major P. FAYNGERSH

Each profession has its specific features. When he learns them, a man accumulates experience and mastery. This stage has been achieved by Officer Yuriy Trofimovich SHILIN, Technician of an outstanding airplane.

From the very beginning of his service at the airport, this officer made it his rule not to pass over details. After all, the success of a flight depends on the smallest nut or bolt.

In honor of the XXIII Congress of the CPSU, SHILIN undertook the duty of perfecting the control circuit for the airplane cockpit pressurization system. The work is serious. The officer kept his word with honor. His efficiency suggestion was accepted and approved by the commission.

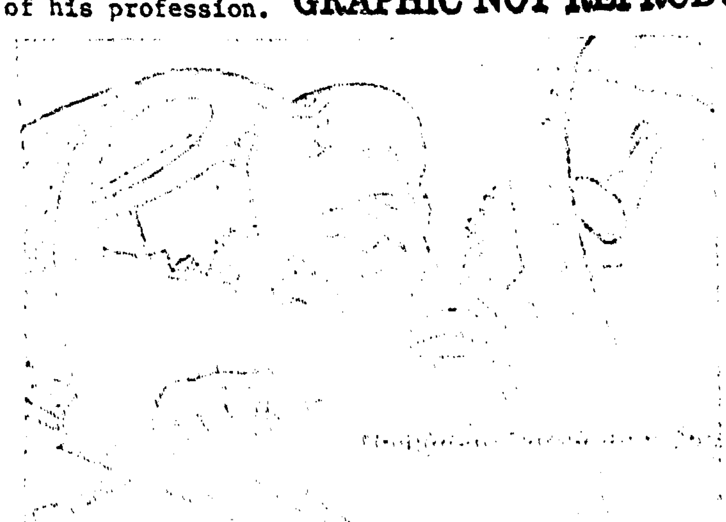
It has now become a tradition in the <u>Chast'</u> to send all new technicians and mechanics to study with SHILIN. They even joke, "if you've passed SHILIN's institute, you will be a genuine specialist."

Yuri Trofimovich is fond of people, understands them and trusts them. Not only from his favorite books, but also from the experience of his life, which has been considerable, SHILIN knows: man can perform surprising tasks. For this to occur, it is only necessary to teach a man to believe in his own abilities.

He gives his attention and a little part of his warmth to each student, and tries to see that which is good and bright in everyone. Young lieutenants VOYKOV, PELIN and GVOZDYREV arrived from school. They had studied another type of airplane. Therefore, these officers felt unsure of themselves with the new type of combat equipment. But SHILIN knew that with time their ability would come through and they would show their mastery. The technician did not err. Now, for example, Officer PELIN has successfully passed the course of study and is now working independently. And his airplane has already been designated outstanding.

Military Technician First Class Yuriy Trofimovich SHILIN has been in the Air Force for over ten years. And each year is a unique course in the institute of army maturity, mastery and experience. In this time, the officer has known the joy of creative labor, the joy of [illegible] the importance of his profession.

GRAPHIC NOT REPRODUCIBLE



Tekhnika i Vooruzheniye, No 8, 1966, pp. 64-66

COOPERATION DURING PASSING

By A. Katayev

Passing is a difficult and dangerous maneuver. With good reason, the traffic rules for the streets of cities, populated points and roads of the USSR completely forbid passing other vehicles under certain conditions (Articles 47, 48, 49). Practice has shown, however, that accidents often occur even when passing is begun with good visibility and an unobstructed road. This usually occurs when the driver, beginning to pass, does not accurately estimate the safe distance required before encountering an obstacle or oncoming vehicles or when an obstacle appears unexpectedly on the road after passing has been begun.

Statistics show that the majority of motor vehicle accidents during passing (up to 65%) consist of a collision between the passing vehicle and the vehicle being passed. Both vehicles travel for a considerable time at high speed with a narrow distance between them, and any deviation of either one toward the other is highly dangerous. Thus, about 12% of these collisions occur because the vehicle being passed turns sharply to the left (toward the passing vehicle) in order to avoid an obstacle in its path. About 20% of these collisions occur when the passing vehicle turns sharply to the right (to avoid an obstacle or a collision with oncoming vehicles).

Thus, even passing begun under completely normal conditions may result in an emergency situation.

An example. A driver with a vehicle going at 70 km/hr decided to pass a vehicle going 50 km/hr. The length of the passing distance required is 275 meters, which will allow him to complete his passing before a bend in the road 400 meters ahead. Let us assume that the driver of the vehicle being passed, against the rules of the road (Article 50) increases his speed by 10 km/hr, having decided that this slight increase in speed would not have any serious consequences. However, with this increase in speed the passing distance increases by more than double (from 275 to 581 meters).

As a result, both vehicles arrive at the curve simultaneously, and both drivers are placed in a very difficult position. We emphasize -- both drivers. The driver of the vehicle being passed, who did not follow the rules and who hindered the passing by increasing his speed, was guilty. On the contrary, he should have reduced his speed by at least 10 km/hr for a brief period. Then the passing distance would have been decreased by almost 100 meters (from 275 to 170 m).

This example shows how important cooperation of drivers can be, and how the safety of this maneuver can be increased.

Complete cooperation of drivers is even more important when an emergency situation arises. As we knew, passing which involves driving in the oncoming lane consists of three stages: the first stage -- leaving the right hand lane and approaching the vehicle being passed, the second stage -- the passing itself and the third stage -- leaving the left hand lane at a safe distance and returning to the right hand lane. In each of these stages, an obstacle may unexpectedly be found in the path of either vehicle, or the danger of a collision may arise. How should a collision be avoided under these circumstances? Let us take a look at the most characteristic cases.

A "Volga" began to pass a GAZ-51. As the vehicles came close together, the drivers saw that a pedestrian had entered the road unexpectedly from the right. A dangerous situation. If the "Volga" continues passing (which the drivers often do), both vehicles will approach the pedestrian simultaneously. Naturally, the driver of the GAZ-51 begins to drive around the pedestrian, turning to the left. The result is a "double passing" situation, which is forbidden by the rules of the road (Article 48, v). This situation often results in collision of the two vehicles (Figure 1) because the passing vehicle has no where to go.

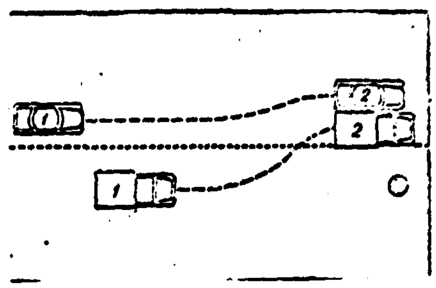


Figure 1.

How can the accident be avoided?

When he sees the pedestrian on the road, the driver of the "Volga" must stop passing, the driver of the GAZ-51 must turn on his left turn signal and move to the left (Figure 2). In this way he will manage to drive safely around the pedestrian and also to inform the driver of the "Volga" of his intentions.

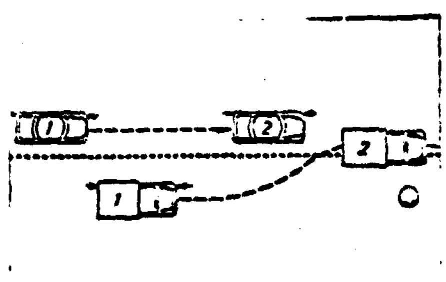


Figure 2.

And what should the two drivers do if the pedestrian suddenly appears at the right side of the road when the "Volga" and the GAZ-51 are even with each other? (The rules of the road and the driving manuals give no concrete instructions for such a case.)

It would seem best to stop the passing maneuver. But this is dangerous. Since the "Volga" is going faster, if it stops its passing maneuver it will not be able to clear the left hand lane. Consequently, the driver of the GAZ-51 would have to attempt a panic stop, although this would not guarantee that he would not hit the pedestrian.

Under these circumstances, the driver of the "Volga" should continue passing, increasing his speed if possible, so as to allow the driver of the GAZ-51 to slow down, move in behind the passing vehicle and drive around the obstacle (Figure 3).

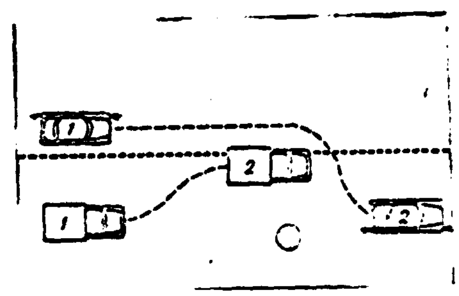


Figure 3.

An obstacle which appears suddenly in the path of the GAZ-51 during the third stage of passing, when the "Volga" is already in front, creates no danger: the path is free to drive around the obstacle.

Obstacles which appear on the left hand side of the road in the first and second stages of passing are not dangerous. The driver of the "Volga" can slow down and return to his lane. It is much more dangerous when an obstacle appears in the path of the passing vehicle in the third stage, especially if this obstacle consists of an oncoming vehicle.

A sharp turn to the right for a rapid return to the proper lane causes the threat of a collision with the vehicle being passed. An attempt to drop back is also a poor maneuver, since the speed of the passing vehicle is great and even applying the brakes may not help, especially since this once more involves the threat of a collision with the vehicle being passed.

Incidently, we often see this situation on the road and many times the driver of the vehicle being passed fails to recognize the danger to himself and continues driving with his previous speed, sometimes right down the center line of the road, making no attempt to help the passing vehicle. The driver of the oncoming vehicle, considering himself to be in the right when in his own lane, also continues. In most cases the oncoming drivers also make no attempt to help the passing vehicle, who is unable to get out of the way.

What should the drivers of the passing vehicle, the vehicle being passed and the oncoming vehicle do to avoid an accident?

Without waiting to move forward a safe distance, the driver of the passing vehicle must turn on his right turn signal and immediately begin a smooth motion to the right, i.e., show the driver of the vehicle being passed that he must reduce his speed and go as far as possible to the right shoulder in order to open a path for the passing vehicle to the right (Figure 4). This will allow him to avoid collision with the obstacle or oncoming vehicle. The driver of the oncoming vehicle also must aid the passing driver to return to his own side of the road. Very little is required of him -- he must simply move to the right hand side of the road and, if necessary, reduce his speed.

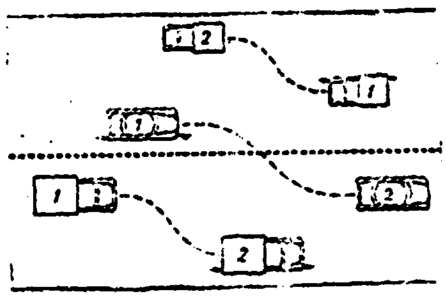


Figure 4.

From the examples above we see that with intelligent cooperation it is not so very difficult to avoid a collision. Each driver will find himself at times in the role of the passing driver, the driver being passed or an oncoming driver. Therefore, he should always follow the principle "help your comrade and he will help you!". Proper cooperation will guarantee safety in passing and make the drivers work easier.

Working on the airplane

Tekhnika i Vooruzheniye, No 8, 1966, p. 67

THE GAS MASK: ITS REPAIR

By Lieutenant Colonel N. MOISEYEV

Various defects may arise in gas masks in the process of usage and storage in warehouses. The action of precipitation, temperature, solar rays and other factors may cause a change in the canister body, rubber, face portion parts, charge or antismoke filter. Depending on the degree and the nature of damage, the gas mask (or some component parts) may become unsuitable for use. Therefore, timely and high quality repair of gas masks is one of the basic prerequisites for keeping them in constant combat readiness.

Three types of gas mask maintenance are differentiated according to the nature of the defects corrected: constant (organizational), medium and capital repair. Organizational repair is performed using the SKIM-M and RPS-2.

The set of instruments, tools, materials and spare parts in the standard chemical technician's workshop is sufficient to repair the threads, sides and sealing ridge of the throat canisters: to straighten the top and resolder leaking areas in the canister, and seal punctures in the face portions; to straighten dents in metal parts; to replace defective parts with new parts; to paint places where the paint layer is damaged; to check the seal of canisters and check them for breathing resistance. Repair of gas masks directly in <u>Podrazdeleniye</u> is performed using the RPS-2.

Canisters are usually painted with a brush. This would seem to be a simple matter. However, observation of certain rules is required here as well. First of all, paint of the proper viscosity must be used -- it should be of a consistency such that it flows easily off the brush when the painted surface is brushed. The brush must be dipped carefully into the paint, and excess paint must be stripped off the brush with the edge of the can.

After this work, the brushes are washed in solvents (gasolene, white spirit, turpentine), than with soap and water. Gas mask canisters are painted with enamels type 1425, 1426 or equivalent paints, as well as with nitro enamel. The painting is performed in the following order. The metal ring holder is placed in the throat of the canister. Holding the canister upside down with the left hand by this throat holder, the paint is applied first to the sides, then to the bottom. After this, the canister is turned throat upwards and, holding it by the loop holder, the top and throat are painted.

In order to avoid unnecessary expenditure of materials or working time on the restoration of canisters which are unsuitable for further usage, they are first carefully inspected. The greatest difficulty in this is usally caused by determination of so-called cobweb rust, which extends from a point source in various directions in the form of very fine threads. It is formed on the body underneath the paint layer. If not discovered in time, it can cause the material to rust clear through in the places where the thread-like rust lines cross. Cobweb rust is usually found by looking for slight bulges in the paint at the rusted locations. A slight amount of rust can be removed from the gas mask canister manually. A wire brush or sandpaper is used. In difficultly accessible places, the rust can be removed with a knife or a special scraper. Locations which are to painted are cleaned until shiny. Only after this is done is the painting begun. After painting, the canister is dried indoors or in the open air. In the latter case, measures must be taken to protect the canisters from dust and dirt. Under natural conditions, with a surrounding air temperature of 18-20°C, the enamel will be completely dried in 36-48 hours. In order to reduce drying time and increase the strength of the enamel coating, the canisters are sometimes dried at elevated temperatures. Thus, at a temperture of 70-90°C, the drying time is reduced to 6-7 hours.

Organizational repair of the face portions of gas masks includes cleaning and painting of metal parts where they are chipped, where the paint is worn and where rust has been removed, as well as replacement of the inhalation and exhalation valves, the gaskets and rusted wire and insulation bands where the valve box, angletube and nipple are fastened. The metal parts of the face portion of the gas masks are painted with 1426 enamel or another equivalent paint.

Restoration of defective gas masks is usually performed by chemical experts, dosimeter instructors or specially trained troops. Training assemblies are organized for training these experts. In the Kiev military district, we perform these assemblies at a warehouse or at one of the chemical corps military chast'. These assemblies last one month. Six hours per day are spent in classes. Also, we provide time for independent work. The following subjects are covered at the assemblies: repair equipment; instruments for testing gas masks; the basic materials used in the process of repair; organization and performance of repair of chemical equipment in organizations; determination of categories of equipment and types of repairs; repair of the universal gas mask. After these assemblies, the participants are given the right to repair protective equipment.

Tekhnika i Vooruzheniye, No 8, 1966, pp. 68-69

AT THE EXHIBITION OF ACHIEVEMENTS OF THE NATIONAL ECONOMY

The first All Union Conference on the problem of programmed learning was held in Moscow from 31 May to 4 June. The delegates of the conference were very interested to see the exhibit of technical learning equipment organized at the "Education" pavillion of the VDNKh SSSR.

We publish herewith a description of some of the exhibits at the exhibition which might be of interest for military Chast's and military educational institutions.

THE LOGICAL TRAINER TSE-OD (Moscow Engineering-Physics Institute) is designed for training technical personnel and students for work with the universal logical elements of electronic digital computers. Inputs and outputs of 32 logical elements, as well as the connecting lines and pulse power supplies are produced using a switching field. By switching the inputs and outputs of the elements among themselves and the outputs of the pulse supply with the corresponding cycle buses, most computer logic circuits can be modelled. The device is so designed that even by error or intentional incorrect switching, the elements of the trainer cannot be put out of order. Power supply is 220 volts, 50 cycles. Required power is five watts.

THE ACTION AND RESULTS RECORDER (Kiev Engineering-Construction Institute) can operate with any testing machine. The actions of the student and the results of his answers to the questions are recorded in a binary code on paper tape (standard telegraph tape 10 millimeters wide). The recorder records the number of the button which was used to give an incorrect reply, the correct reply to the question, return of the machine to its initial state (clearing), the thought time before answering each question and the numbers of the questions.

THE CONTROLLING DEVICE TYPE KVU (Military Engineering Academy Imeni F. E. Dzerzhinskiy) is used for colloquiums tests (examinations) of groups of students, and also as a drilling aid for independent study of programmed textbook literature in preparation for tests and examinations. The number of students which can be accommodated simultaneously is up to 30. The number of questions on each card is up to 10. Evaluations are given on a five point (percentage) system. Power supply is 220 volts AC or 4.5 volts DC. The weight is 7 kg.

THE PORTABLE SPEECH LABORATORY APPARATUS (Moscow Engineering-Physical Institute) can be used during exercises in a foreign language course. It consists of a teacher's control panel from which a two channel tape recorder can be operated, 16 small individual amplifiers and 15 microtelephones for the students. Using this installation, the teacher can transmit a phonogram of the lesson to each location, check the operation of the students, record their action on the second channel selectively, listen to the recording of the second channel (simultaneously with the phonogram of the first channel).

The teacher can speak individually to each student during the course of the lesson and also remotely control a slide or movie projector. Power supply is 220 volts, 100 watts. The dimensions of the apparatus are 0.6 X

0.6 X 0.8 m. The weight is 60 kg.

THE INFORMATION MACHINE OPI-101 (Odessa Polytechnical Institute) is designed for storage and output of extremely varied information, depending on the program stored within it. The memory volume is 10,000 pages of typed text. The average access time for output of any information is three seconds. The information is displayed on a ground glass screen. Power requirements -- 100 watts. Weight -- 70 kg.

"SNEZHINKA" EXAMINING MACHINE (Perm State University Imeni A. M. Gor'kiy) is used for automation of testing during examinations, practical exercises and laboratory work, as well as for self testing by the students. It can be used for any course of study, both theoretical and purely practical, whose content consists of the study of any apparatus.

The "Snezhinka" allows the method of direct introduction of the answer and the multiple choice method to be used. When the time allowed for thought on one question is up, the machine checks for correct answer and moves on to the next problem.

The answers of the students are differentiated into four groups: "correct", "not completely correct", "incorrect", "gross error". When an answer contains a gross error, the machine halts the examination. If the answer is not completely correct, it reduces the grade. The evaluation of the examination as a whole is displayed on the scale of the instrument under the headings: "unsatisfactory", "satisfactory", "good" and "excellent". Power supply required is 200 volts, 40 watts. The size of the device is 500 X 315 X 310 mm.

THE INDIVIDUAL TEACHING MACHINE "GAMMA-3" (L'vov Pedagogical Institute) is used for learning using a branched learning diagram and for development of programs. The information memory volume is 30 sections, each of which contains 22 frames. The material is studied by visual projection of the information and presentation of checking questions. When a proper answer is given, the projector automatically shows the following stage of information: when an incorrect answer is given, the projector automatically shows an explanation and presents another test question. The image on the screen is 200 X 300 mm. Power supply is 220 volts, power consumption is 135 watts, the size of the apparatus is 600 X 520 X 450 mm.

THE MODEL MA-1V AUTOMATIC TEACHING MACHINE (Riga Polytechnical Institute) is universal and has a wide range of application. It can be used in two primary modes (checking, learning) individually in a centralized way or both at once. Additional instruments are used for this. There is also a special recording installation, the RETE-4, which can be connected to the automatic teaching machine. This makes it possible to use the automatic machine for experimental-methodological and scientific research purposes.

The MA-1V differs from other similar automatic machines which use the multiple choice principle by several advantages: rapid preparation for work, minimal loss of time for changing programs (a few seconds), high reliability and convenience in servicing. Program materials are prepared in the form of cards on a typewriter. The power supply required is 220 volts, up to 57 watts; the dimensions are 475 X 300 X 225 mm.

Tekhnika i Vooruzheniya, No 8, 1966, pp. 68-69

THE SEARCH GOES ON

The contest announced by the Journal *Tekhnika i Vooruzheniye* and the Department of Inventions of the Ministry of Defense, USSR is in its eighth month.

What must we do to make the contest of maximal use in the remaining time? The answer to this question is brief: we must show the maximum of initiative on the part of the participants in the contest themselves. You should not limit yourself just to the recommendations of the magazine, but rather should undertake an independent search, studying all that is new, all which should be introduced.

The conditions of the contest, published in many military districts and in the fleets, call for just this. Thus, for example, in the directive published in the Moscow military district, it is suggested that commanders and chiefs organize the selection and introduction of inventions described in the patent literature, the list of new patents being available in Oblast' libraries, as well as technical achievements shown at the Exhibition of Achievements of the National Economy, which allow improvement in methods of usage, conservation and repair of military equipment and weapons, improvement of the learning process, increased productivity of labor at repair enterprises and savings in money and materials.

The First Deputy Commander of the Armed Forces in the Pricarpathian Military District demanded in his directive: "when officer specialists go on temporary duty to Moscow, they should be ordered to visit the Exhibition of Achievements of the National Economy in order to select valuable work, instruments, etc., suitable for introduction in their Chast'."

Enterprise chiefs in the Belorussian Military District have been recommended to coordinate all work performed in the development and introduction of new equipment as well as all rationalizer work with the conditions of the contest and to use more widely the technical solutions published in the patent literature.

All centrally subordinated motor vehicle repair organs are encouraged to strengthen the selection and usage of inventions from patent sources as well as the selection, study and usage of the best achievements of inventors and innovators of production -- the participants of the Exhibition of Achievements of the National Economy.

Thus, the victor in the contest will be he who best organizes the search and who most efficiently provides for the introduction of new inventions.

It should also be noted that it is not necessary to make long journeys to become familiar with descriptions of domestic inventions. Patent materials are collected in 97 republic, Kray, Oblast' and city libraries.

The editors of this magazine are sure that the officer specialists of district and fleet administrations and departments and the armed forces, the main and central administrations of the Ministry of Defense, USSR, will provide constant aid to the troops in this great and necessary work.

In studying new inventions, the thought always occurs: we have found a better solution here. In this case, we recommend that a report of the invention be filled out and an application for a patent be made.

Ever more people in military uniforms can be seen in the pavillions of the Exhibition of Achievements of the National Economy and in the libraries, studying patent literature. The great search goes on!

Tekhnika i Vooruzheniye, No 8, 1966, pp. 70-75

THE PRESENT AND FUTURE OF CIVIL AVIATION

By Ye. Loginov, Minister of Civil Aviation, USSR

The directives of the XXIII Congress of the CPSU with respect to the five year plan for development of the national economy of the USSR for 1966-1970 call for further development of civil aviation. Air transportation during this period should increase by approximately 1.8 times. This will allow us to transport no less than 75,000,000 people by air in 1970.

Here are a few remarkable figures. In 1958, something over 8,000,000 passengers travelled by air in our country. By the end of the seven year plan, in its final year, the services of civil aviation were used by over 42,000,000 people. The total volume of journeys increased by 25-30% each year in the seven year plan. In the 15 year period 1950-1965, passenger traffic increased by 31 times.

Air transportation now penetrates to the most remote regions of the country. In a number of places, it has become the principle means of travel. In the summer months, for example, 85% of all passengers between Moscow and Ashkhabad travel by air, 15% by rail; from Moscow to Khabarovsk, these figures are 77.5 and 22.5%; from Moscow to Tbilisi, the figures are 63 and 37%.

The airplanes available to Aeroflot were considerably renewed over the period of the seven year plan. The basis of this renewal was multimotor, high speed jet and turboprop airplanes. The first step, as we know, was the TU-104 jet, designed by A. N. Tupolev. At first, its passenger capacity was 50. As it was being used, the design team together with the workers of Aeroflot "raised" the load carrying capacity of this machine to 70-100 passengers. The cruising speed of the TU-104, supplied with powerful jet motors, is 750-800 km/hr and more. This means that a passenger flying from Moscow to Khabarovsk travels approximately 11 hours, including two landings on route.

The TU-114, whose cabin can carry 170 passengers, is an even more perfected airplane. Airplanes of this type are used for regular trips on internal and foreign airlines. They can fly to Cuba and to India without landing en route. The TU-114 makes daily trips without landings on route from Moscow to Khabarovsk, travelling over 7000 km in eight hours.

Soviet travellers making moderate length trips have been very satisfied with the new jet TU-124. It is designed for 44 passengers. Its design incorporates the latest achievements of aviation technology. It is equipped, in particular, with improved wing mechanization equipment and flaps; this makes it possible to take off and land on comparatively short runways. Its cruising speed is the same as the TU-104.

The workers of Aeroflot have had a long and friendly relationship with the design team headed by S. V. Ilyushin. In the first few years after the war, the piston powered IL-12 and IL-14 made up the primary part of the long distance airplane fleet. Now, they are to be seen only on local lines. The turboprop airship IL-18 is very popular among travellers today. This machine is manufactured with several modifications, designed for 89-111 passengers.

Its cruising speed is 600-650 km/hr. The IL-18 makes non stop flights over such routes as Moscow-Tashkent, Moscow-Frunze, Moscow-Alma-Ata, Moscow-Ashkhabad and makes only one stop between Moscow and Southern Sakhalin. Testing has just been completed on a new modification - the IL-18D. During the testing, Hero of Socialist Labor B. A. Anopov and his crew flew non stop in this machine from Moscow to Vladivostok and from Petropavlovsk-Kamchatskiy to Frunze.

The fleet of Aeroflot contains entire families of airplanes. One of these is made up of the airplanes of O. K. Antonov: the AN-10, AN-12, AN-24 and AN-2 are successfully used, in particular, in agricultural production. I would like to especially note the comfortable AN-24, which holds 50 passengers and is designed for middle and short range lines. Replacing the piston powered IL-14 and LI-2 on these lines, the AN-24 and TU-124 will be called upon to play a large role in the second stage of the technical reconstruction of Aeroflot -- the introduction of high speed comfortable airplanes to local lines.

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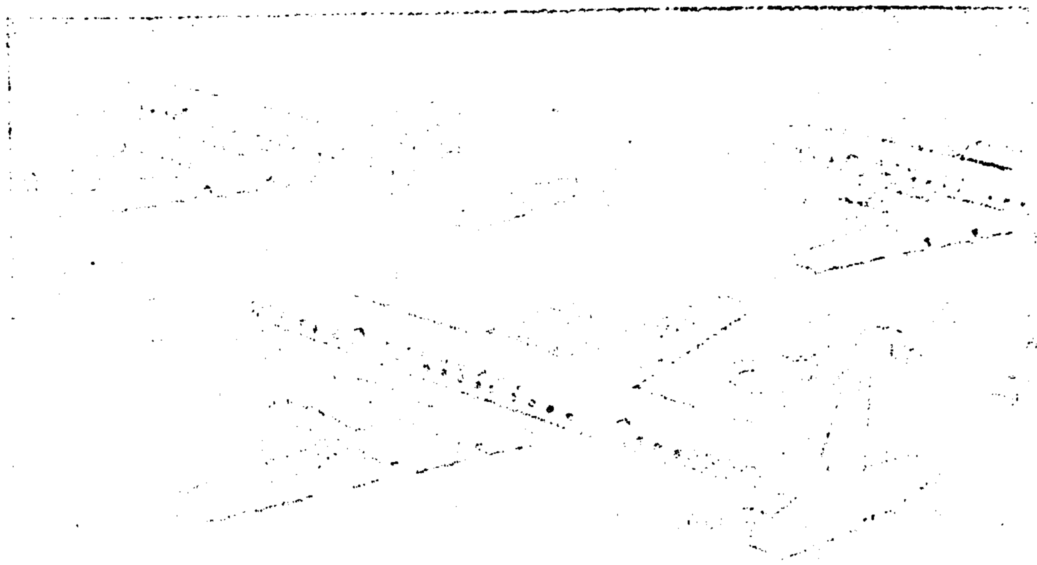

Soviet civil aviation has become jet propelled and comfortable. Over 4/5 of all passenger traffic travels on high speed, multi motor, jet and turboprop airplanes. The speed of modern airplanes exceeds the speed of ground and water transportation by 10-15 times. The time is near when passengers will use supersonic airplanes. On the photograph: a normal working day at Vnukovo-1 airport.

In recent years, the helicopter fleet has been considerably supplemented. This has allowed organization of regular helicopter service in many areas of the country, mainly where it has still not been possible to construct modern airports for airplanes. The helicopter can land literally "on a spot" in the Tayga or even in swampy areas. In the five year plan period just being started, special attention will be turned to even wider usage of rotary wing machines to provide the needs of the national economy.

Our designers have done a great deal and are doing even more in order to supply the Soviet people with even better air transportation in the coming five year period. In the immediate future, the IL-62 Intercontinental Jet Passenger airplanes will begin to be delivered. In contrast to similar machines, the motors for this airplane are installed not on the wings but on the rear portion, which prevents noise from penetrating into the passenger cabin.

The creation of new passenger airplanes and helicopters for civil aviation is being performed by the large design teams lead by A. N. Tupolev, S. V. Ilyushin, A. S. Yakovlev, O. K. Antonov, M. L. Milyan and N. I. Kamov. Work is going forward successfully on the creation of the first Soviet supersonic airship the TU-144, a model of which was demonstrated at the World Aviation Exhibition in Paris last year.

The TU-154 is being developed for civil aviation. Three fan jet motors are installed on the rear of its fuselage. Its speed is 900 km/hr; it can carry 160 passengers for a distance of 3500 km. In the future, this airplane will be modernized to increase its capacity to 220 passengers.

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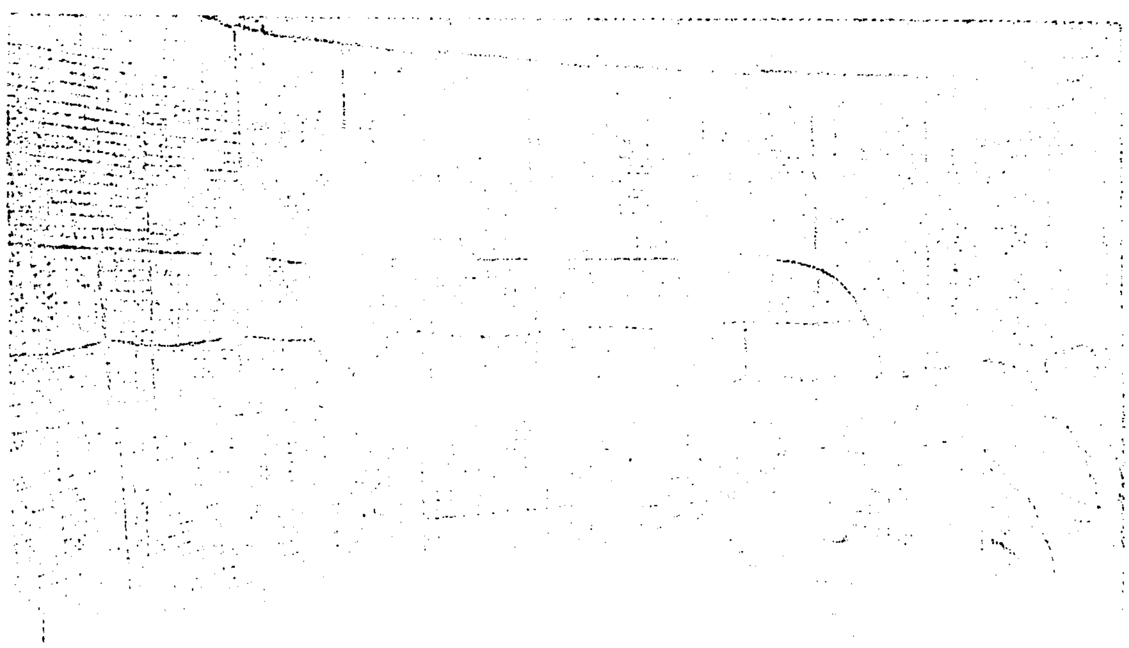

The information and reference service at civil aviation airports is well organized. On the photograph: the Information Bureau of the Moscow Aviation Center.

For local airlines, the YAK-40 medium capacity airplane, which will carry 24 passengers up to 600 km, is being developed. Its cruising speed is 550-600 km/hr. The airplane can take off from sod airports no more than 700 m long. The TU-134 and AN-22 airplanes are undergoing testing. The helicopter fleet is also being enlarged. The airlines and national economy will make use of considerable numbers of V-2, V-8, KA-26 and other types of helicopters.

When we speak of the wide introduction of jet equipment as being the basis for technical progress in aviation, we mean primarily such important factors as the resulting increase in speed of communications. The speed of our airplanes exceeds the speed of ground and water transport equipment by 10-15 times. However, the speed of travel depends not only on the capabilities of the equipment, but also on the ability to use it affectively. More briefly speaking, an increase in the technical speed capabilities of our airplanes is also accompanied by a proportional increase in the commercial speed, that is by a reduction in the time a passenger spends on route.

As a result of the renewal of the air fleet and expansion of the sphere of its application, an increase in the commercial speed of 2-2.5 times was achieved in the seven year plan period. This has resulted primarily from non-stop long range flights and the variety of flight paths over which non-stop flights are made. For this reason, the central schedule controlling flights on all main line airlines shows ever more and more new flights. Last year, this schedule was increased by 306 flights, this year another 150 have been added. Each long distance flight provides an economy of time of about 40 hours in comparison with railroad travel over the same path. If this time is multiplied by the number of passengers using the services of Aeroflot, tens of millions of hours which can be used for useful labor and rest of the Soviet people are produced.

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He has seen 30 years of faultless service in civil aviation, over 14,000 hours in the air, 4,000,000 km of peace time flying.

Todays Senior Pilot Inspector Oleg Sergeyevich Grigor'yev of the Moscow Transport Administration is mastering a new airplane -- the Intercontinental IL-62 passenger liner.

One more important factor in air travel is the regularity of flights. Since the time when jet airplanes began to be introduced in our country, the regularity of flights has been increased by almost 30%. However, there is still much to do in this respect. A passenger travelling from Moscow to Vladivostok cannot understand why the airplane doesn't take off. "Look," he says, questioning the airport workers, "the weather is beautiful, but you talk about poor meteorological conditions." Actually, the weather at Moscow is fine, but at Sverdlovsk or Novosibirsk there is a low cloud cover and the airplane cannot land there.

It should be noted that, due to the introduction of ever better navigational, autopilot and landing equipment, the limitations which nature can place on aviation will be reduced to a minimum. The directives of the XXIII Congress of the CPSU on the five year plan foresee the installation of systems of automatic and semiautomatic control of landing and of radio equipment for control of the movements over the airlanes at airports. This means that in the new five year plan air transportation will become all-weather in the full sense of the phrase.

Now the airplanes being used, plus those arriving for usage, are being equipped with such modern navigational systems as the "trassa" and the RSBN-2. Also various semiautomatic pilot command systems which give the pilot prepared commands for fulfillment of landing approaches with low cloud cover and limited horizontal visibility are being installed on the airplanes.

The automatic equipment called for by the directives of the XXIII Congress of the CPSU will allow landings to be made with zero vertical and horizontal visibility. The pilot will only check the operation of these instruments, and will not touch the stick or foot pedals.

It is understandable that the development of civil aviation is impossible without a great deal of on ground construction, primarily airports. Over the past seven years, the network of airports for jet airplanes has greatly expanded at many points in the country. The Moscow Aviation Center, consisting of four airports, has been basically redesigned. One of them, Domodedovo, has the highest passenger throughput capacity in the world.

Passenger terminals are being built in consideration of future development of air travel and rapid servicing of passengers.

The directives of the XXIII Congress of the CPSU for the five year plan call for measures for further expansion of the usage of aviation in various branches of the national economy, primarily in agriculture. The contemporary level of our agricultural aviation is much higher than in any other country, both as concerns the quantity of area treated and as concerns the productivity of the air fleet. Airplanes and helicopters perform half of the work on destruction of crop pests, 70% of the work in weed control and 100% of the work of preparation of cotton plantations for machine harvesting.

In the final year of the five year plan, agricultural aviation should treat over 115 million hectares in our collective and state farms. Mineral fertilizer will be spread over an area of about 50 million hectares. Performance of this work using ground equipment would require 18 thousand tractors and over 50 thousand fertilizer spreaders.

The many thousands of workers of Aeroflot, inspired by the resolutions of the XXIII Congress of the CPSU, will go forward to meet the day of the air fleet with new achievements in labor. Mastering their new equipment, increasing the affectiveness of its usage, the pilots, navigators, engineers, technicians, and workers in the passenger and freight services will insure the achievement of high profitability, regularity and safety of flights, and improvements in passenger service. All that is done in our subdivisions has one goal -- improving our service to the national economy and the Soviet people and providing more effective usage of our equipment.

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Yevgeniy Makarov, the young Commander of an AN-2, is one of the outstanding pilots of the Vladivostok Airport.

The Communist Party and the Soviet Government surround the workers of civil aviation with constant care and attention, highly evaluate their difficult but necessary work for the people. The honored ranks "honored pilot of the USSR" and "honored navigator of the USSR" have been established for the pilots and navigators, and are awarded for special service in mastery of modern aviation equipment, the usage of the most improved methods of flying, high indicators in education of pilot staffs, many years of safe work or outstanding achievements in the usage of aviation in the national economy.

The clarity of the goals, the magnitude of the tasks, the concern and attention of the party in government lift up the workers in the fifth ocean, call forth reserves of energy and creative forces, plus a striving to work better and to more actively intr duce the achievements of science, technology and front rank experience to production. Therein lies the guarantee of successful performance of our tasks in the next five year plan.

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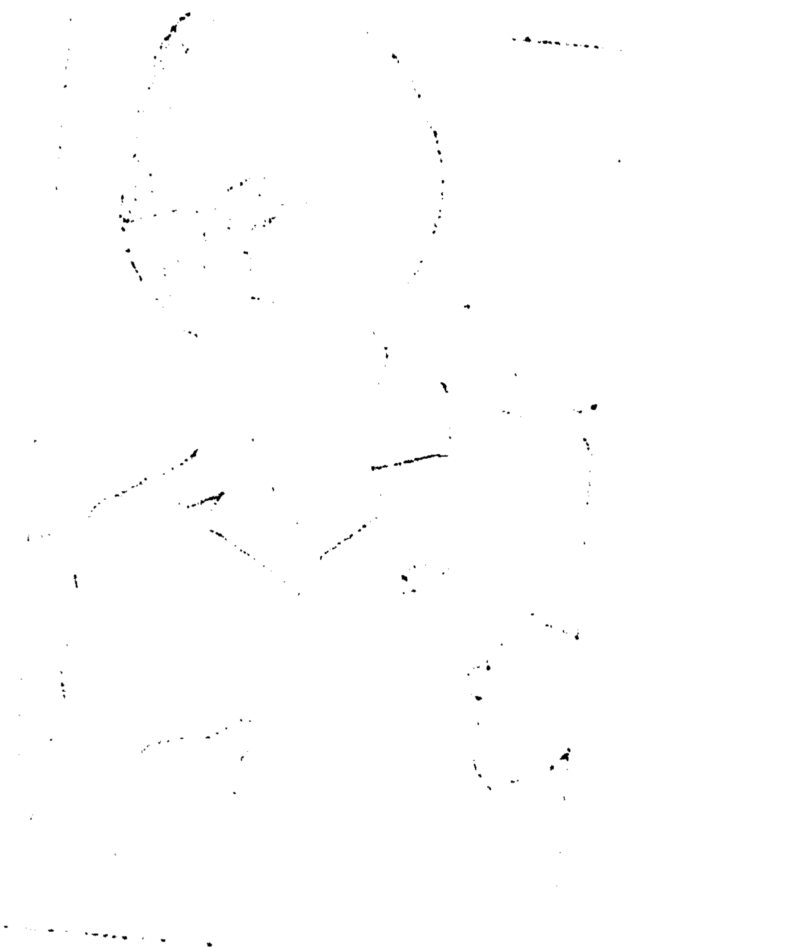

You are not an aviator, you are on a jet passenger liner for the first time; the distance to the ground is almost 10 km, and you are a little nervous. Then, the charming stewardess appears in the cabin, and your courage returns. Valentina Sergeyevna Mozzhukhina, member of the Komsomol, Shock Worker of the Communist Labor, TU-104 stewardess, has been working for Aeroflot for over eight years. Comfort and friendly attention await you on board her airplane.

Tekhnika i Vooruzheniye, No 8, 1966, pp. 76-79

A LIFE DEDICATED TO SCIENCE

By Colonel of the Technical Service A. KISELEV

The day before Victory Day, 6 May of this year, in the great Kremlin Palace, the Chairman of the Presidium of the Supreme Soviet of the RSFSR presented a group of comrades official notification of the awarding of the Rank of Honored Inventor of the Russian Federation. Among those who received this rank was Doctor of Chemical Sciences Engineer Colonel K. A. PETROV, Head of a Chair of the Military Academy of Chemical Defense.

The biography of Konstantin Aleksandrovich is similar to the biographies of many of his contemporaries.

Study in a rural school, an attraction to chemistry. A trip to Moscow.

In the mid 20's finding work in Moscow was not easy. Those looking for work included 16 year old Kostya. With a great deal of difficulty, he managed to enter a communal farm as a worker. A good deal of time passed before he was able to fulfill his dream -- the agricultural worker became a student at the Mendeleyev Institute. Starting with his third year, he was transferred with a group of students to the Military Technical Academy, from which he graduated.

Thus did the son of a peasant become a Commander in the Red Army, a chemical specialist.

When he was still a student at the Academy, Konstantin Aleksandrovich showed unusual capabilities, willingness to work and curiosity. The command staff saw these qualities in the student and decided to leave him in the department. Since that time, scientific and teaching work has become the goal of his entire life.

From the first days of his work at the department, Konstantin Aleksandrovich has actively performed scientific investigations. With the years, he has also achieved experience in teaching activity. His continuous unstinting labor, his untiring search for that which is due allowed the young engineer to defend his candidates dissertation before the beginning of the Second World War, after which he wrote his doctors dissertation and defended it.

During the Second World War, K. A. PETROV dedicated all his abilities to scientific research work and the training of highly qualified officers. He also worked at studying captured weapons. His work was a valuable contribution to the chemical protection of the troops.

At times, Konstantin Aleksandrovich did not leave his laboratory for days. Sleep, rest, home were forgotten. When PETROV's wife asked the duty officer if she could see him, he replied:

"He is alive and healthy. He asks you not to worry. He is busy, he is working. You don't know his nature..."

In the post war years, K. A. PETROV's activity has not been limited to the development of technical military problems. He also solves problems with great national economic significance. In the journals *OBSHCHAYA KHIMIYA* (General Chemistry), *PRIKLADNAYA KHIMIYA* (Applied Chemistry), *NEORGANICHESKAYA KHIMIYA* (Inorganic Chemistry) and others, approximately 150 of his scientific works have been published.

A large folder will hardly suffice to contain the patents which this scientist has been awarded for his inventions. In the three months before he was awarded the Rank of Honored Inventor of the RSFSR, he was awarded 72, by the day the decree was published the number had increased to about 80. And each invention is the result of intense creative labor by the team in which K. A. PETROV has the leading role.

Careful readers of the Bulletin "Inventions. Industrial Models. Trade marks" will frequently see the name K. A. PETROV in its pages. In recent issues of the Bulletin it has been seen numerous times under headings such as "A method for making wood chip material such as sawdust fire resistant", "Method for producing dialkyl phosphates" and "Method for producing dichloranhydrides of alkoxyvinyl or alkoxialkyl vinyl - thilphosphinic acids".

The determination in the soul of the scientist and his persistence in attaining his goal was indicated by the words of Karl Marx when he said that in science there is no wide high road and that the shining heights of science will be attained only by those who, not fearing exhaustion, clamber up its rocky paths. These words can be applied in their fullest sense to the activities of Konstantin Aleksandrovich PETROV. It is often necessary to perform hundreds of experiments and overcome dozens of doubts before the truth is established. His extreme love for his work and his unstinting labor and continuous desire to overcome nature and her finest secrets have aided K. A. PETROV in his scientific research.

K. A. PETROV performs his scientific activity in close connection with production. It is his firm opinion that a scientist, if he wants to serve not "pure" science, but rather the people, the great goals of the construction of Communism, must occupy himself with problems which directly influence technical progress.

Looking upon science and technology as a single whole, K. A. PETROV boldly combines his scientific activity with practice; he supplements his investigations with the development of concrete designs and methods, whose introduction will produce a valuable contribution in the development of the national economy.

Being a chemical specialist as he is, he works fruitfully in the area of discovery of physiologically active materials, flame resistant polymers and medicinal substances. Recently, he has turned a great deal of attention to the chemistry of extracting agents. They must not only be synthesized, but production must be organized. In this work, K. A. PETROV plays a leading role. Automated production of phosphates and phosphonates has been organized under his leadership.

"All success," Konstantin Aleksandrovich says, "is connected with the organization of production, with the achievement of high economic effects; success would be impossible without the great help which has been shown us by the workers of the plant. It is even difficult to say who has done the most in order to introduce new things."

Thinking a little, K. A. PETROV adds:

"Anyone who plans on success without the aid of production is definitely heading for failure. The entire strength of the scientist is in close cooperation with the plant. Without this cooperation, he cannot feel the pulse of the times, the requirements of today. He must know production to the finest detail and must not be a guest in the plant, but rather a member of the plant team."

And these are not empty words. Once, about ten years ago, K. A. PETROV was assigned the development of a contemporary theme. After his first successes, the question of organization of production arose. The author of the theme went to the plant himself, where he was received with great enthusiasm. The workers of the plant, once they knew what the problems before them were, started to work solving them with enthusiasm. Many co-authors of inventions and scientific developments have been developed in the process of seeking a method for beginning new production. Since that time, K. A. PETROV has been at home at the plant. He visits there often. The representatives of the plant often go to see him for consultation. Close communication has been established between the scientist and many workers of the plant.

K. A. PETROV is talented and likes to work. But not only talent and work brought him to the great Kremlin Palace. A considerable role in the successes he has achieved has been played by the aid and support of his team, his commanders and the party organization of the Academy.

We wish Konstantin Aleksandrovich PETROV further successes in his work. May his persistent and intense searches always end in interesting scientific and technical discoveries.

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Engineer-Colonel, Doctor of Chemical Sciences, K. A. PETROV, Honored Inventor of the RSFSR.

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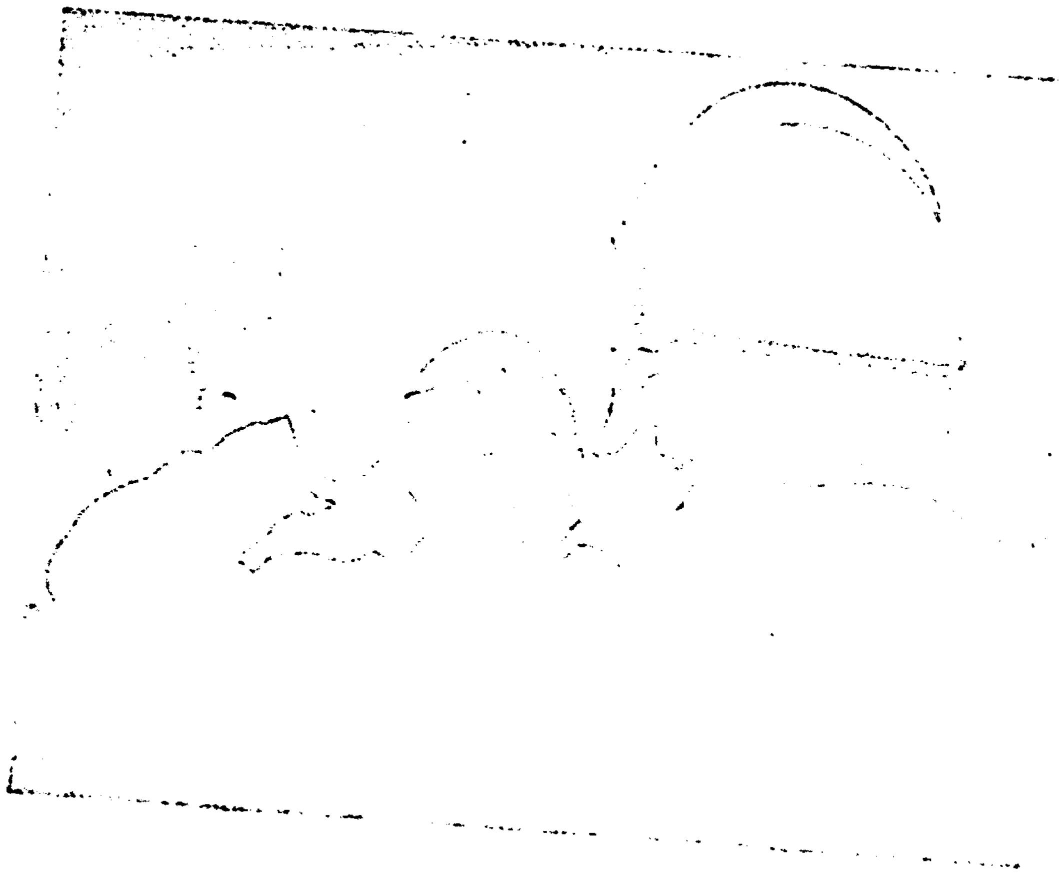


"The airplane is ready to fly!" reports Guards Technical Lieutenant V. GRIDCHIN

Tekhnika i Vooruzheniye, No 8, 1966, pp. 78-79

TO THE YOUNG RIFLEMEN

By Lieutenant Colonel A. YAKOVENKO

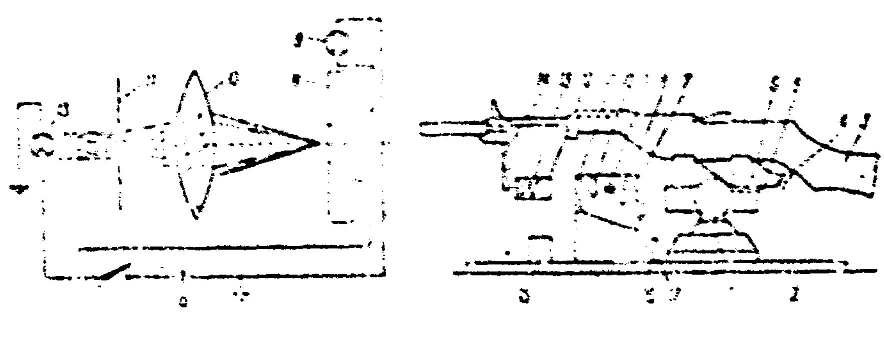
The State Committee for Inventions and Discoveries of the USSR has presented a patent to Senior Sergeant (extended service) V. Vishnyakov for an electro-optical device for training in target sighting with a rifle.

Many such devices are known. In almost all of them, photo cells are installed on the targets. These devices have natural errors in accuracy of aiming. They cannot be used in bad weather under field conditions

In the device created by V. Vishnyakov, the light rays go from a source fastened on the barrel of the rifle (see figure) though a diaphragm and lens and fall on a photo attachment which is fixed in a recorder on the frame of the base. This base allows the weapon to be moved both vertically and horizontally.

Only a small amount of time is required to prepare the device for operation. The weapon is placed in the base, then the plug is connected with a wire to the adjusting bar of the trigger. After this the tube bar is mounted under the bayonet mounting screw, the power supply is connected to the photo resistance and the source of light, the stop screw of the target support is loosened and the power supply is connected. The illumination lamp in the tube and the checking lamp both light.

By changing the position, the focus of the light beam is matched up with the aperture in the photo resistance. In this position, the checking lamp lights. Then, the stop screw of the aiming support is tightened, placing the target at the required distance, and the center of the target is placed in the sighting line. The stop screw is released and the rifle is turned off target. The device is ready for operation.



Electro-optical device for teaching sighting with the rifle: 1, sighting support; 2, frame; 3, rifle; 4, firing hammer adjustment; 5, wire; 6, stop; 7, recorder body; 8, photo resistance; 9, checking lamp; 10, double convex lens; 11, diaphragm; 12, tube; 13, illuminating lamp; 14, arm; 15, power supply; 16, contacts; 17, cut off switch.

When the student "fires" (when the trigger is pulled), the wire pulls the stop and the weapon is fixed in place. If the "shot" was accurate, the checking lamp will not light. In case of a "miss" the lamp lights, and the deviation of the beam can be used to judge the error made in aiming.

Tekhnika i Vooruzheniye, No 8, 1966, pp. 81-85

EXPERIENCE, INITIATIVE

An AMPLIFIER ATTACHMENT CIRCUIT (Figure 1) for the R-105 radio set has been developed by Private V. Yavorskiy. As soon as the talk button is pushed on the microphone of the transmitter, relay P_1 operates in the circuit connected to the receiver of the radio station, closing the charge circuit of condenser C_2. The result is an increased current through transistor T_2, causing operation of relay P_2, which connects the low frequency amplifier.

Relays P_1 and P_2 are type RP-4, in which the contacts are connected with one side dominant. Transformer Tp may be any output transformer. The circuit is powered by 12 volt batteries.

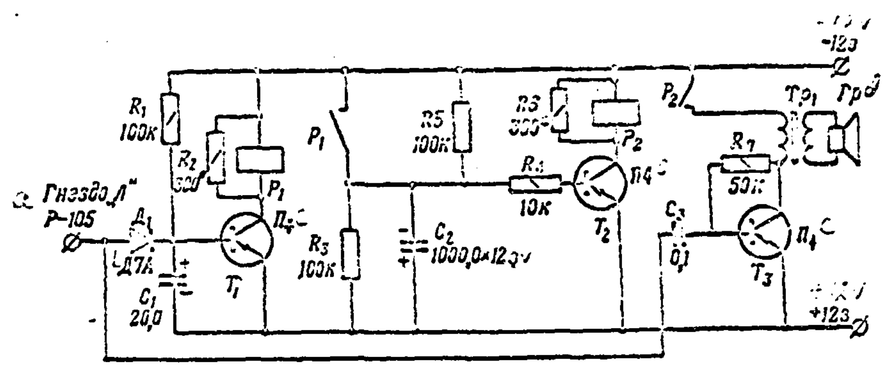


Figure 1. Key: a, "L" contact of R-105; b, D7A; c, P4; d, loud speaker

The DICTAPHONE P-180 (see *Tekhnika i Vooruzheniye*, 1963, No 11) can be used during visual aerial reconnaissance. In order to keep the observers voice clear, Engineer Lieutenant Colonel L. BERKOVSKIY suggests a few improvements. For example, in place of the dynamic microphone, an ordinary carbon throat microphone type La-5 can be used; a FMTs battery can be connected in series in its circuit.

The electrical power supply of the dictaphone when used in an airplane is either independent -- from the batteries in the instrument, or from the airplane power supply. In the latter case, the power supply voltage should be lowered to 12-14 of v, by connecting an additional load.

The instrument can be easily carried even in the small cabin of an MI-1 helicopter and provides continuous recording for two hours with one K sets. The availability of separate channels for recording and reproduction makes it possible to check the recording using earphones, The information recorded can be transmitted to the command point directly by radio from the airplane as it flies through the air. After returning to base, the magnetic recording can be listened to individually or in a group, using head sets or an amplifier plus loud-speaker.

CLEANING OF THIN CAST IRON CYLINDER LINERS can be performed without a honing machine if a special head (Figure 2) designed by Engineers V. Sokol'nikov and N. Khartsiyev is used. The upper cone 1 of the head is connected with the spindle of a boring machine, the lower mount 6 is centered in the cylinder of the motor block. Fingers 2 with spherical clamps hold planks 3 which contain knurling spheres 4 plus the supporting bearings. Cutter 18 is mounted to the body with a bolt. Its position is controlled by screw 13.

The sliding supports 9 of the planks slip along the sliding supports of the controlling insert 8, thus expanding or contracting. If the planks are compressed together, the head will pass freely into a cylinder of nominal dimensions; when they are expanded, the maximal diameter of the head is 2 mm greater than the third overall diameter of the cylinder. Spring 5 is set to a predetermined force with control screws 10.

When the spheres pass out of the cylinder liner, thruster 7 enters the stop installed on the base and raises the tilting support, which compresses the planks together. At the uppermost position, the tilting support is held by stop ball 15 riding on lever 14 in the body of the support.

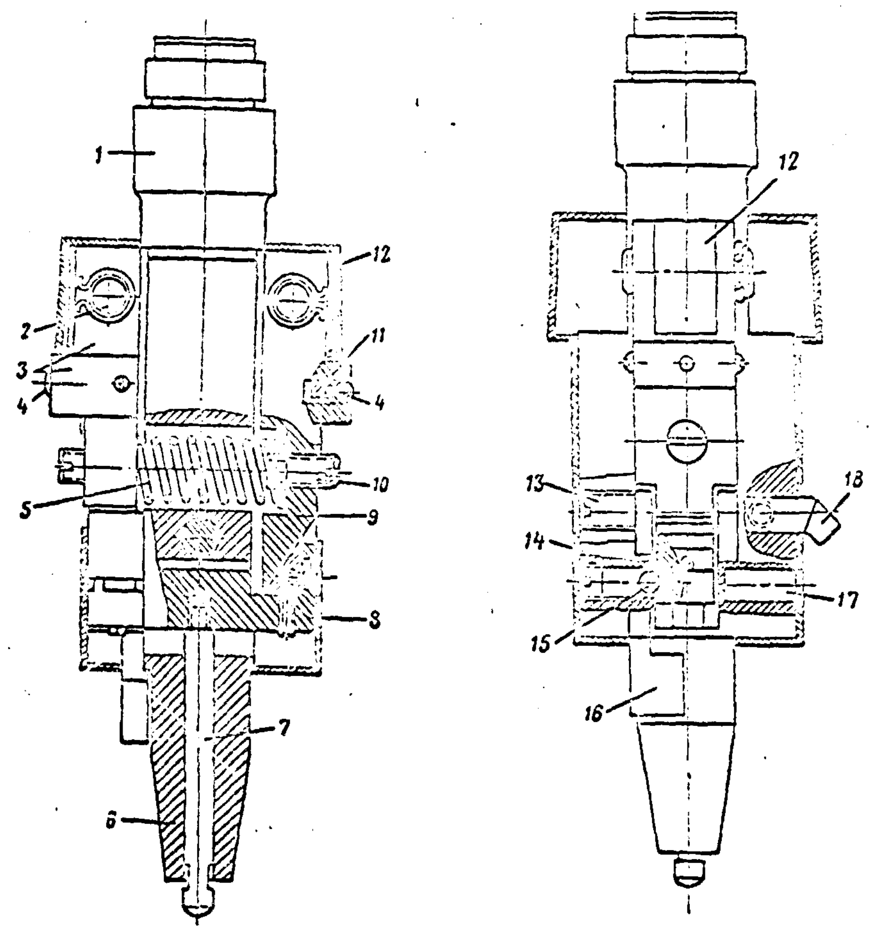


Figure 2.

In order to start processing the next cylinder, it is only necessary to press the start lever 16 with one finger. When this is done, the ball drops out of the groove, and the support and thruster are placed in the position for beginning work. Before beginning treatment of a cylinder, a cutter is placed in aperture 17 to remove the chamfer.

Engineer Lieutenant Colonel V. SOKOL'NIKOV reports that the method of simultaneous boring and flattening of cylinders in one pass using this head allows a reduction of labor expenditures for processing cylinders of approximately 40% and an increase in the wear resistance of the cylinders.

The ATTACHMENT (Figure 3), suggested by Sergeant I. Derkach is designed for turning brake drums directly on the vehicle. A vice 6 is welded onto a frame 2 made up of two number 30 channel bars; the non moving side of the vice is replaced by slide block 1. The transverse portion of support 3 with blade retainer 4 is fastened to this slide block. Special limiters restrict side displacement of these supports. Before beginning turning of the brake drums, the vehicle is raised by a jack and placed on blocks. Then the wheel is removed and the brake drum 5 is set as shown on the figure. The attachment is placed on the ground and lined up. The vehicles motor is started and, setting the motor at low speed, first gear is engaged for turning the left drum, reverse for turning the right drum. The cutter is set on the surface to be turned and the drum is turned.

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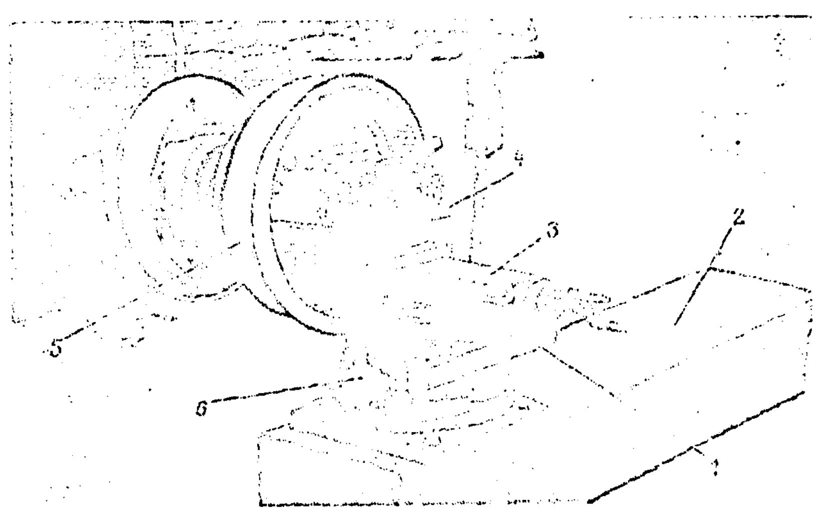

Figure 3.

A NEW METHOD FOR MAKING SCREEN FILTERS has been suggested by Candidate of Technical Sciences A. Fal'kov, Engineers V. Terent'yev and V. Krivov and Engineer Lieutenant Colonel V. VOLKOV-MUZYLEV. According to the method which they developed, the connecting seams, flange and strengthening rib of the filter are made of a polymer material (Figure 4). This is done using an ordinary casting machine and break apart press forms.

Under pressure, the melted polymer fills the channels in the area of the joint, coating the screen cell. The screen is formed into a filter by butting or overlapping ends, screens of any alloy or material which has a melting temperature no lower than the melting temperature of the polymer being usable. Another advantage of this method is that it can be used to join two different materials, as well as screens with different cell diameters and wire diameters. Also, polymer can be used to make various elements of the products.

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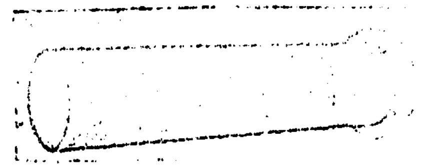

Figure 4.

Tests have shown that the plastic filler filter elements are stronger than brass or steel screen usually used in filters, have high anticorrosion stability. The method suggested, the authors report, allows automation of the process of filter manufacture.

A TILTING DOLLY, made by a group of rationalizers was reported by Engineer Lieutenant Colonel N. RAKHMANOV. It allows raising metal drums up to 250 kg to a height of one meter, agitation of the paint or other liquid which they contain and pouring of this liquid into another container.

The frame 1 (Figure 5) holds guide rails 2. The bracket 7 rolls up and down these rails. The drum 6 is held by two lips, one welded to the bracket the other being moved by a screw. Depending on the drum diameter, different holders are attached to the lips. The bracket is raised by the hand winch 8 with reducing drive of 28:1. The gears on gear wheel 3 mounted on the bracket axis engage the gears on the arm of the left side of the dolly. Turning arm 5, the drum is tilted to the required angle and held by stop 4. The dolly weighs approximately 75 kg. It can be easily moved by one man.

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Figure 5.

A DEVICE for cutting circular metal parts with natural gas (invented by Yu. Burdeynyy and V. Myshonkov) provides for high cleanliness of the cut and reduces the expenditure of metal by reducing the allowance required for mechanical processing. It consists of a holding frame 1 (Figure 6) with guide rails 2 for movement of dolly 3 (tractor from two electrode welding installation ADSD-500), rollers 7 and the container for prepared parts. The dolly holds vertical mount 4 with a bracket which holds cutter 6. The cutter is raised and lowered with screw 5.

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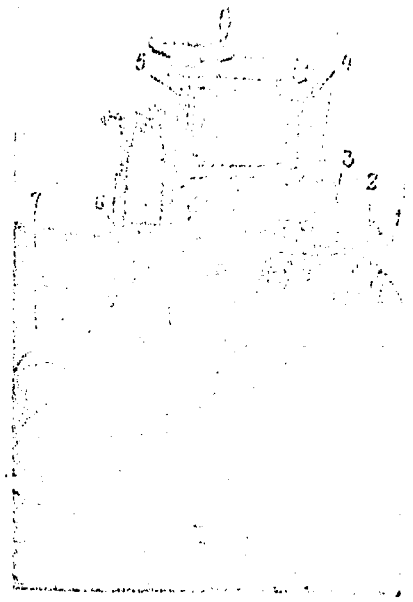

Figure 6.

MECHANICAL CLEANING of the threaded portion of the plugs in TM-46 mines and MVSh-46 fuses can be conveniently performed using the type I-133A electric sharpener, with a 100-150 mm diameter X 25-30 mm thick wooden disk attached to its shaft. Card clothing is attached to the disk with nails (15-20 mm). The plug 2 is retained with a special attachment — wooden arbor 1 with formed bracket 3 (Figure 7). The bracket is made of tin and fastened to tilt to the arbor. There is an apertures diameter is equal to the diameter of the external portion of the plug in the center of the bracket.

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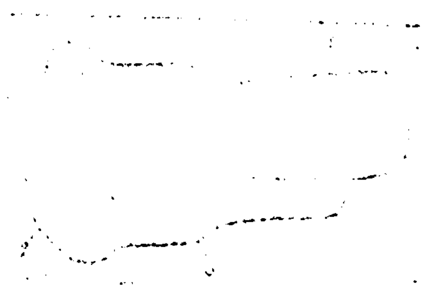

Figure 7.

The TIME FOR SERVICING TYPE TM-46 MINES (cleaning of internal thread of head from grease) can be considerably reduced, reports Lieutenant Colonel

V. MISNIK and Major SABENIN, if the device shown on Figure 8 is used. Its body is made of wooden boards and beams. The upper brackets are fastened with angle braces and 40 mm wood screws. Electric drill 1 type I-29A, spindle rotating rate 310 rpm, is firmly attached to the body. Wooden arbor 2 covered with card clothing is placed in the chuck. The mine is placed throat downward. Its position is fixed by four braces wrapped in felt. The rotating arbor rapidly cleans the thread.

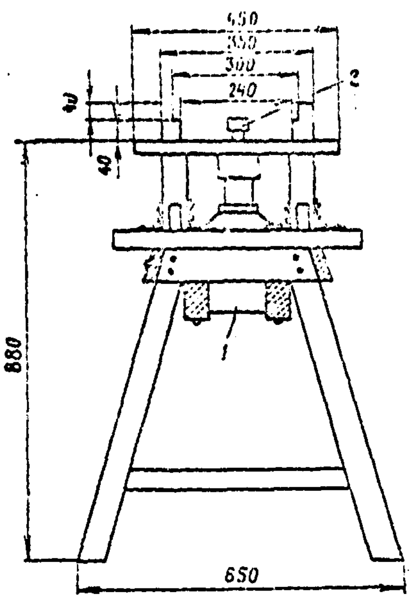

Figure 8.

THE HERMETIC SEALING OF THE EXHAUST SYSTEM OF A HEAVY TANK IS TESTED ON DRY LAND using the device (Figure 9) created by rationalizers in the Chast' where Engineer Lieutenant Colorel A. TUKHVATULIN serves. It allows creation of the same exhaust back pressure as is produced by the corresponding usage of the equipment. The device consist of a tube 1, 28 mm in diameter and 970-1000 mm in length, valve 2 and weight 4, weighing 4.5 kg, mounted on rod 3. The standard motor protection valves are removed from the exhaust jet 5 and the devi here described is installed in their place. The baffle plates over the engine compartment are removed, the rear hatch is opened and the flaps of the dust ejection pump circuit from the air cleaner are opened. The motor is started and a check is made forexhaust gases in the engine compartment. If necessary, the radiators of the motor system are removed, the hatch covers are opened over the cover nuts and the location and reason for leaks are determined. This inspection should be performed during quarterly maintenance, during number 3 technical maintenance and also if defects in the exhaust system are determined. The minimum necessary number of attachments is four (the number of jets per muffler). If 11 devices are made, the sealing of one cylinder block can be checked with one starting of the motor. After this, the device is moved to the other side of the tank and the sealing of the other cylinder block is checked.

The CHARGING DEVICE of the gasoline powered generator of the AB-8-T/230M electric power station has been improved by Engineer Lieutenant Colonel P. SERDYUK and Engineer Ye. Ostrozetser. In addition to the standard elements, they installed DPDT switch S and two clamps or plug breaker B for connection of an external electric circuit (Figure 10).

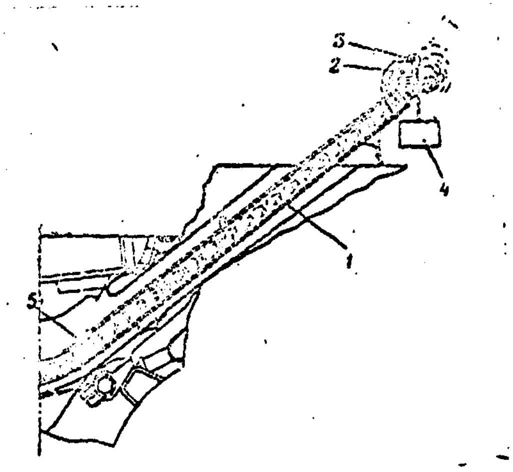

Figure 9

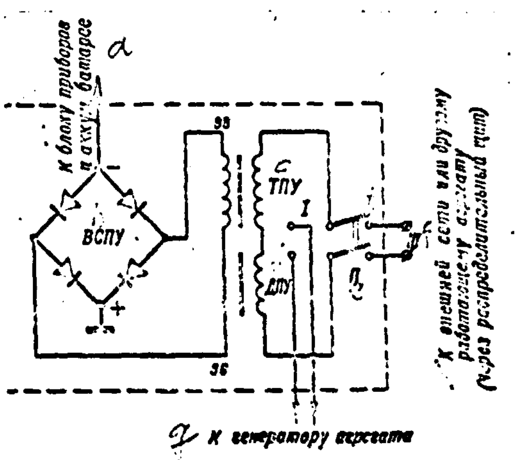

Figure 10.
a- to instrument panel and storage batteries; b- VSPU; c- TPU; d- DPU; e- P; f- sh; g- to generator; h- to external mains or other operating unit (through distributing switchboard) (TN- Expansions unknown)

The starter batteries of these units are now charged even when the electric power station is operating from an external AC line. As a result, there is a savings in engine hours and in fuel and lubes.

The SPRAYER (Figure 11) suggested by rationalizer Senior Lieutenant S. BOTOV is designed for burning diesel fuel in the BU-4M bucking installation. It consists of two frames, each 220 by 400 mm. One of them (the upper) is an evaporator made of 1¼" diameter tubing, the other is made of 3/4" tubing. The frames are interconnected by three 3/4" diameter nipples. The fuel line, a 10 mm diameter tube 50-60 cm long, is welded to the evaporator frame. A rubber hose is attached to the end of the fuel line and the fuel is fed in through it. The fuel supply is regulated by a valve.

Nine holes, 1.5-2 mm in diameter, which serve as discharge jets are drilled in the lower frame. The weight of the sprayer including the packing box and fuel container is 1015 kg. The time required to prepare for operation is one or two minutes. Warm up time with an external air temperature of 15°C is five to seven minutes. Fuel consumption is six to seven liters per hour. The time required to heat 350 liters of water from 15°C to the boiling point is 45 minutes.

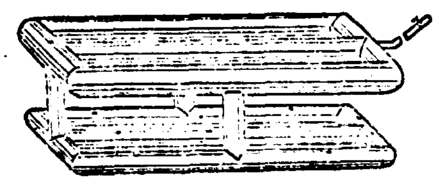

Figure 11

A CLASS TRAINER for studying traffic regulations allows a teacher to check the correctness of the solution to a problem by a group of students in a few seconds, reports Engineer Lieutenant Colonel F. POZOYSKIY.

The equipment consists of a panel display with a signal light, 24 transparencies and a device for setting up intersection plans; a control panel placed on the teacher's desk; 24 panels for the students, set on eight tables; a set of outlines of typical intersections; models of motor vehicles, road signs, etc., installed on magnets. The lamp under each transparency of the display panel is connected by wires to contacts of the corresponding switches of all individual panels. The equipment is supplied with power by the AC mains through a step-down transformer.

The outline of an intersection with the motor vehicles installed on it is set on the display panel. The signal light is lit and the students are instructed to move the vehicles in the permissible directions. The students set the switches on their control panels in the positions which they consider to be correct. If the answer is correct, lamps light on the display panel. Using this equipment, the correctness of answers to questions can also be checked by preset program cards.

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